CHEMICAL & METALLURGICAL ENGINEERING

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A PAIR OF ACES

UP OUR sleeve, so to speak, are a couple of trump cards—our "openers" for the game that starts in 1937. In January, following the pattern set a year ago, we should like to be thinking about important chemical engineering trends in certain process industries that have been most active during the past few years. Pulp and paper, are essentially two industries that fall in this category. Plastics have been "going places," with many new products of chemical industry finding many new markets in larger-scale uses. Closely related are synthetic organic chemicals from petroleum. Textiles is become more and more a field of chemical engineering interest. And so is sugar refining, in which important advances have recently been made—especially in crystallization, filtration and centrifugation. All these are fertile fields for January's cultivation.

In February, the emphasis swings again to economics. Chemical raw materials for process industries present a multitude of interesting developments that will have determining influence on our industries in 1937. Commodity summaries and distribution studies that have always characterized CHEM. & MET'S. series of annual review and statistical issues take on a new and greater significance. Pricing trends and policies, inter-commodity and inter-process competition, Robinson-Patman and other legislative influences are but a few of the reasons that chemical engineers must continue to be economic-minded as they tackle the problems of 1937.

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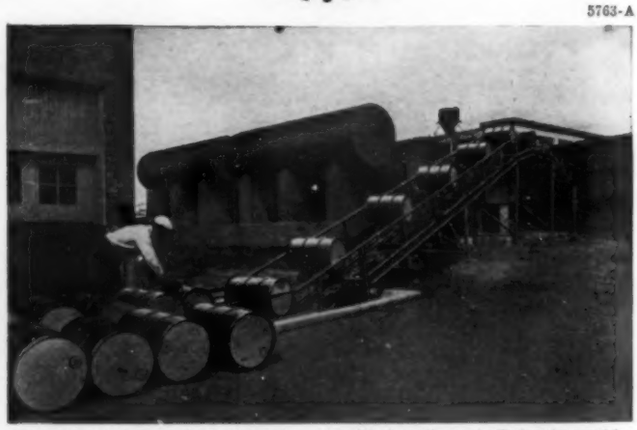
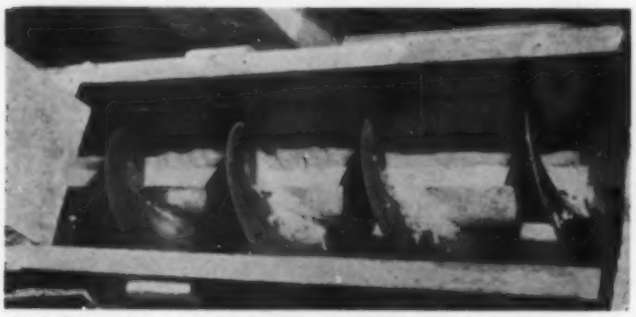


Heavy steel drums of printing ink are handled easily and efficiently on this Link-Belt conveyor, at the plant of Howard Flint Ink Company, Detroit. Conveyor operates in either direction, permitting it to handle drums to or from railroad car.



Link-Belt makes conveyors of every type for handling all materials. The illustration to left shows a Link-Belt screw conveyor handling salt, and at the right, a conveyor of the belt type as used for handling loose materials. Industry can reduce costs and increase profits by using Link-Belt conveyors.

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S. D. KIRKPATRICK, Editor

DECEMBER, 1936

TOWARD A MORE SECURE PEACE

"IF HE'S LUCKY, a million men will die!" So reads an advertisement of World Peaceways that appeared in November issues of *Scribner's* and certain other magazines. Perhaps you saw it and had some thoughts about it which you would like to compare with ours:

The illustration, you may recall, is that of a begoggled research chemist—"working on the development of a more deadly and inhuman poison gas." The story is that of a brilliant young scientist, "top man in his class," who might have made some brilliant discoveries in medicine but instead must search for new chemical means of destruction. All this, it seems, is in preparation for that "next war" when "planes will zoom over cities and towns and children will fall down strangling from one breath of air that a second ago had been clean and sweet."

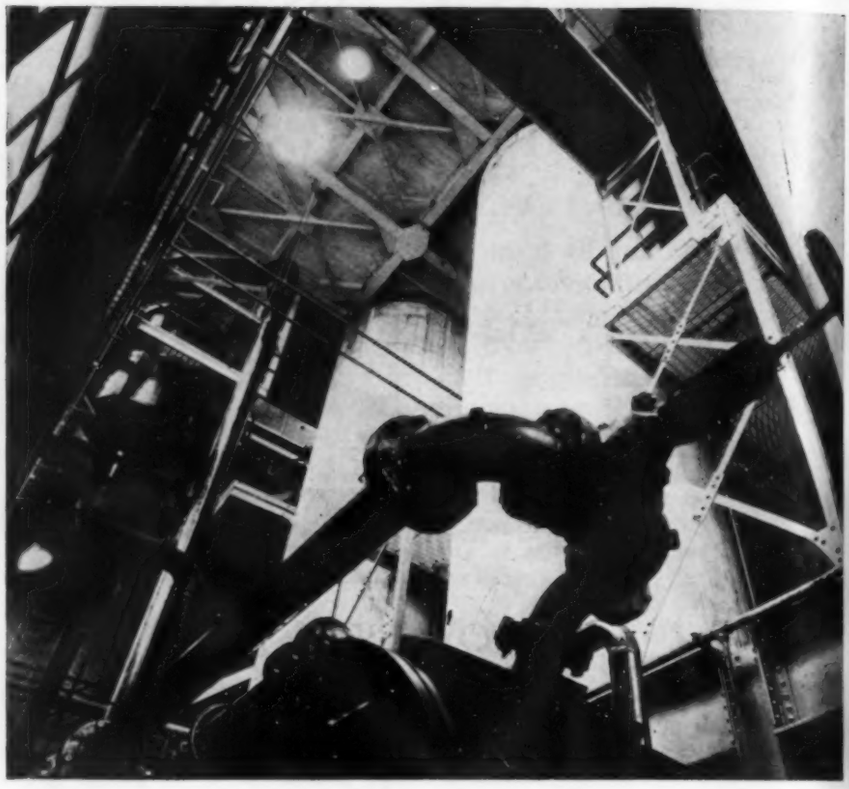
The clear implication is that the chemical profession is part of a ruthless handful intent on dragging the decent people of the world into a horrible chemical war. The advertisement warns the reader against "extremely clever appeals to his emotions"—against "extremely ingenious propaganda" from this same chemical "handful who want war."

In more than twenty years of fairly intimate association with the American chemical industry, we have yet to find any chemical manufacturer guilty of such low tactics. Nor has frequent contact with hundreds of research laboratories revealed a single instance where, in times of peace, any research chemist has been at work seeking new and more poisonous gases. A very small group in the laboratories of the Chemical Warfare Service has studied poisonous gases from a purely defensive viewpoint—to devise means of protecting our people against known substances and those likely to be developed in the future. But surely World Peaceways would not have us abandon such chemical research in the fervent hope that their advertising will so quickly change the ways of the world.

We know no member of the chemical profession who will not heartily endorse the purpose of this non-profit organization, namely "to solidify the desire most people have to abolish the whole silly business of war." We have good reason to feel, with them, "that intelligent efforts can and must be made against war and toward a secure peace." Quite contrary to popular belief, the chemical industry and the chemical profession are opposed to war for very selfish as well as humanitarian reasons. Our greatest advances, and profits as well, have come from purely peace-time pursuits. And the most attractive opportunities awaiting future development are those contributing to the health and comfort of living—not to death and destruction.

For the very few who might profit temporarily from war demands, there are hundreds of chemical companies and thousands of chemists and chemical engineers rendering a great constructive service to the American people. They will gladly join any intelligent effort toward a more secure peace but that program of cooperation could well start with an apology by World Peaceways to the entire chemical profession.

FROM AN EDITORIAL VIEWPOINT



» "Careers After Forty"

WHEN THE optimistic author of "Life Begins at Forty" gets around to writing its projected sequel, perhaps he could draw a moral from the life history of the diesel engine. Introduced into the United States just forty years ago by the late Adolphus Busch of St. Louis, it had a rather trying struggle for its existence until very recent years. In 1932 sales amounted to less than 100,000 hp. but in 1934 they jumped to 750,000 hp. or almost double the pre-depression peak. Then the 1935 figure practically trebled that peak and the estimate for this year is the almost unbelievable total of 2,100,000 hp. But as Mr. Kettering told the "Diesel Day" celebrants, during the Power Show here in New York, even this is picayune compared with the 500,000,000 automotive horsepower. The real future of diesel power lies ahead and many process industries will benefit from it.

» Hail and Farewell

"TO THESE trailmakers whose courage matched the dangers of the land, this bit of earth is dedicated forever." So reads, in part, the marker on the Death Valley grave of two desert men who, long ago, were a part of that hearty crew, first to bring borax to the American public. Thanksgiving Day, this year, saw the completion of a final, commemorative run of the famous "Twenty-Mule Team," a trip last made in 1889 when the pioneer borax producer ceased working the original Death Valley sites. Almost 50 years later Pacific Coast Borax Co. duplicated that last 30 day run, in an age when modern transportation makes the 330 mile trip from workings to railhead and return, in a matter of hours.

Not every American chemical industry has had its roots in so picturesque and dangerous a past as the borax industry. All the more reason, then, why today's chemical pioneers owe a debt of deep respect to those earlier

prospectors and entrepreneurs whose foresight gave America its first domestically produced borates. Names such as those of Aaron Winters, the discoverer, and F. M. Smith, W. T. Coleman, and J. W. S. Perry, the developers, should be graven boldly on the records, a constant reminder that boards of directors and tax bills did not always constitute the most serious of industrial hazards.

» Fuel Interdependence

FUEL INDUSTRIES overlap and interlock in the United States. Oftentimes difficulties are not readily adjustable because of the divergent interests of coal and coke or of gas and petroleum groups. Closer technical allegiance is theoretically easy. But corporate cooperation cannot always follow as promptly as would be desired.

Last month in *Chem. & Met.* the editorial interpretation of gas industry trends (page 603) included one suggestion for entry of the gas man into petroleum refining on a small scale. As a "tit-for-tat" it seems logical to suggest also that the petroleum man might well go deeper into the gas business. There is at least one specific way in which this might have great advantage for the gas man, as well as the petroleum industry.

The seasonal curves for the consumption of gasoline and of city gas naturally supplement one another. When we are using most "gas" in the auto tank, we use the least gas in the household, and vice versa. With natural gas a starting material, there is a remedy for these two unfortunate seasonal variations.

Suppose, for example, a huge pipeline were to bring the great surpluses of sour wet gas, now largely wasted in the Texas Panhandle, northeastward into the busy industrial territory. A gasoline polymerization plant could use this in varying amounts, according to the season. And the rest of the year a uniform load on the pipeline would be ensured by city-gas demands for dry gas from which sulphur had been practically all removed.

The load on the poly-gas units would be variable, occasioning low capacity load factors and correspondingly high capital cost per unit of gasoline made. But the bulk of the investment would be in transmission equipment and lines, for sulphur removal, and related gas-handling facilities. All that equipment would run at 100 per cent load factor, with correspondingly low capital cost.

» Better Non-Metallic Raw Materials

SAMPLES of ceramic ware made by T.V.A. at Norris, Tenn., were presented to the electrochemists during the recent meeting at Niagara Falls. This product represented a combination of two advances. A high-grade pure clay, recently discovered in North Carolina, contributed substantially. New methods of electric-furnace firing were also an essential part of the development.

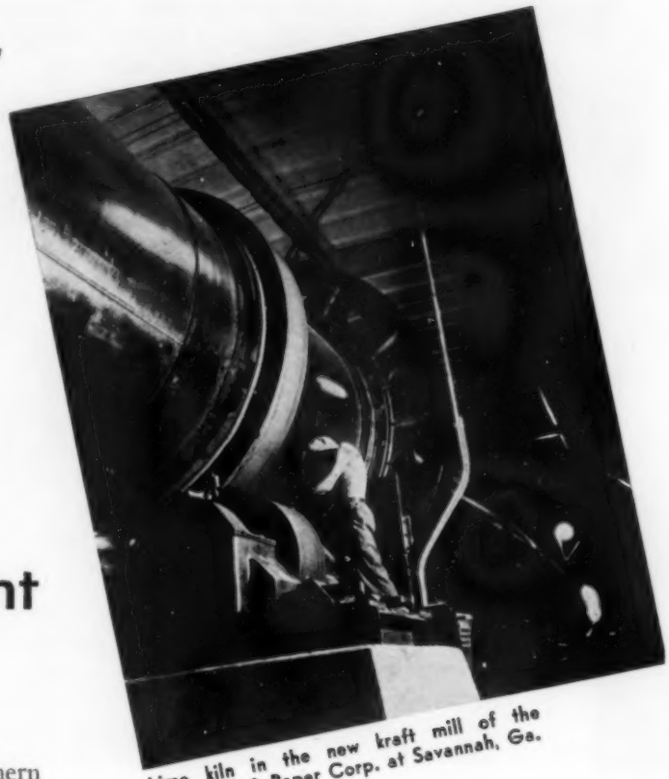
Perhaps the greater of these two advances is the notably superior quality of domestic clay. This deposit, seemingly, is going to contribute substantially to the non-metallic industries of the southeast. Especially if proposed beneficiation for removal of mica and iron is a success, wide utilization seems sure.

American producers of non-metallics have too long neglected both further exploration and needed work on beneficiation. Where the producers have lagged behind, the user industries can well step in. Every process industry which requires a filler or a non-metallic raw material should press every opportunity for exploiting new domestic supplies.

By JAMES A. LEE
Managing Editor of Chemical & Metallurgical Engineering

Chemical Industry Writes

A New Chapter in Southern Development



Lime kiln in the new kraft mill of the Union Bag & Paper Corp. at Savannah, Ga.

THREE YEARS AGO a new chapter in the Southern process industries was opened with the announcement of plans for the construction of an alkali plant in Texas. Although only a brief period of time has elapsed since that news an enormous amount of capital has already been invested in new process industry plants; in fact the sum is sufficient to make this one of the most important chapters in the industrial history of the Southern States. Since Jan. 1, 1935 the almost unbelievable figure of $130,700,000 has been appropriated for the modernization and expansion of existing plants and for the construction of new mills of many types. Over $60,000,000 of this amount has gone into pulp and paper mills, $13,000,000 for petroleum refineries, nearly $8,000,000 for distilleries, $7,000,000 for rayon plants, approximately $5,000,000 for glass, $3,000,000 for fertilizer, $1,000,000 for sugar refineries, $1,700,000 for cement mills and the remaining millions of dollars for a large number of other process industry plants.

Some of the earliest chemical industries in America were established in the South. As early as 1608 attempts were made to manufacture tar, potash and glass in Virginia; and in 1620 iron, salt and leather were actually made in that region. Legislative steps were taken in 1707 to encourage the production of saltpeter and potash in South Carolina; and the culture of indigo in that area in 1741 was the beginning of the natural dyestuffs industry in this country.

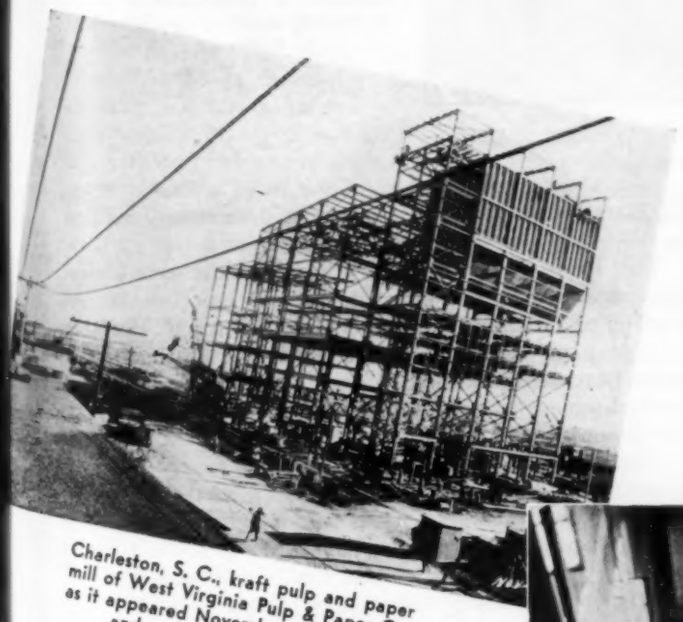
Through the intervening years the chemical industry has made further strides in the South. In 1914, 22 per cent of the entire industry was located there and by 1933 it had been increased to about 30 per cent. Since that time several things have happened to bring about an even greater expansion of the process industries in the states south of the Potomac and Ohio Rivers.

The South holds many attractions for industrial development. The area contains approximately one-third the acreage and one-third the population of the United States; but as it is primarily agricultural, it is largely dependent on the East and Middle West for manfactured products. Considering the vast market, the tremendously valuable natural resources that cannot be duplicated in any other section of the country, the enormous deposits of salt, sulphur, coal, natural gas, lime, clays, glass sand, petroleum and other materials, the adequate supply of cheap labor, power, water, excellent transportation facilities, and a mild climate, it is undeniable that no area offers greater opportunities to industry than does the South.

When it became obvious that the forces of the depression had spent their energy and business showed definite signs of returning prosperity, it was natural that plans for expansion that had been held in check were released. The trend towards decentralization that had begun in the 1920's was continued with even greater vigor with the renewed expansion program. The South is doing all it can to encourage this by offering rent free buildings and a period of years without taxes. These states see an opportunity to balance agriculture with industry.

The pushing of unionization plans is doing much to build up sentiment favoring decentralization. It is evident that wage increases can be forced to the point where decentralization of industry will be undertaken at a more rapid rate than has been contemplated hereto-

fore. To a large extent this will mean the establishment of new plants in the South. With its lower scale Southern plants will have a competitive advantage that soon will result in attempts to fix minimum wages. The Southern States will refuse to accept differentials that will slow down their development. There is a feeling that the section was victimized by the differentials in N.R.A. codes. They are determined not to be caught napping again. There will be insistence upon much wider differences.



Charleston, S. C., kraft pulp and paper mill of West Virginia Pulp & Paper Co. as it appeared November 15. Digester and pan rooms are shown

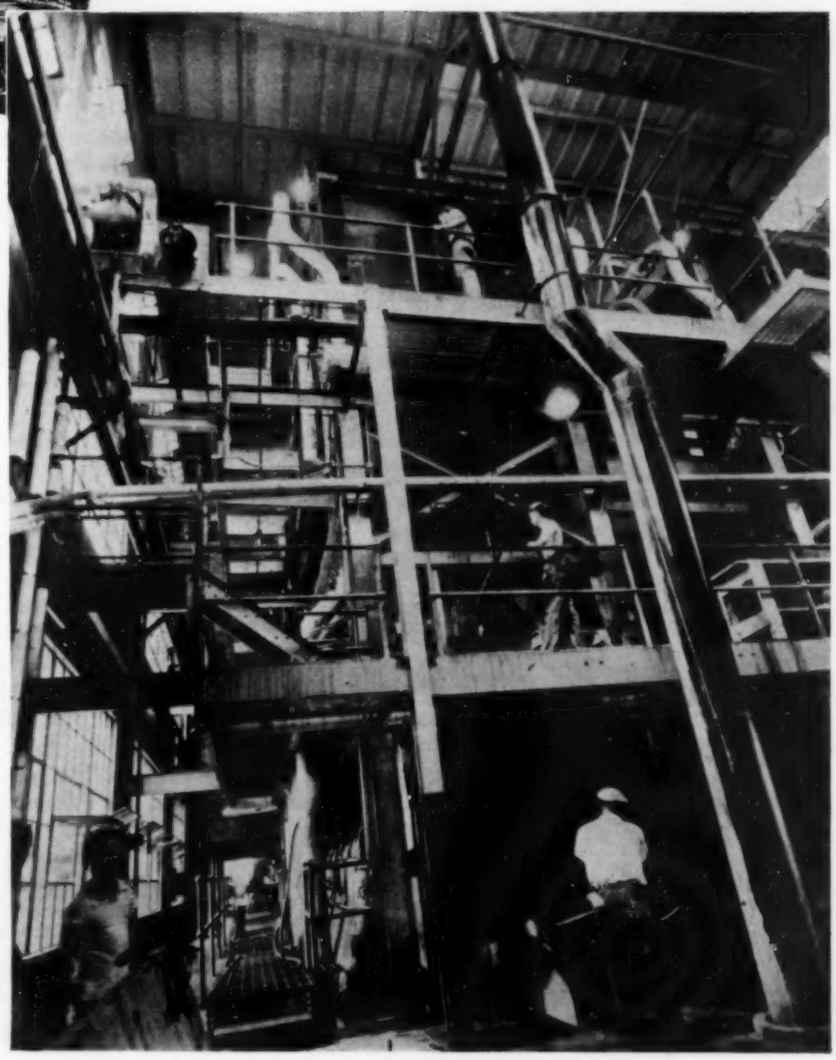
What may be considered the first of these plants is that of the Southern Alkali Corp. at Corpus Christi, Tex. On the heels of the news of this undertaking came announcement of alkali plants at Lake Charles, La., for the Mathieson Alkali Works, and at Baton Rouge, La., for the Solvay Process Co. These three plants gave the South a supply of alkali for the first time. As this is one of the most important chemical raw materials for many process industries, an adequate local supply served to attract other industries.

About the time that these alkali plants were completed the Southern development was given an even greater boost by the rapid-fire announcements of ten new kraft pulp and paper mills. Some idea of the speed of this almost explosive development may be obtained from the fact that before two of these mills could be completed the managements realized their original plans were inadequate and decided to double the capacities of the mills. The kraft mills that are under way will increase the pulp production from 3,500 tons daily to over 6,600 tons. With one exception the new mills are being located along the Atlantic and Gulf Coasts from near Norfolk, Va., to Houston, Tex. The lone inland mill is at Crossett, Ark.

One of the most recent mills to be announced is that of the Albermarle-Chesapeake Co., at Franklin, Va. It will have a daily capacity of 200 tons of kraft pulp. Plymouth, N. C., is reported as the site chosen for the 500 ton kraft mill of the Keickhefer Container Co. This mill will be composed of a large group of units, equipped for an immense output and is reported to cost in the neighborhood of $5,000,000.

The largest kraft mill in the world is being built by the International Paper Co.'s, subsidiary, the Southern Kraft Corp., at Georgetown, S. C. Ground was broken recently for this $8,000,000 kraft pulp, paper and board mill. It will have a capacity of more than 625 tons of pulp per day. Operations will probably commence about Oct. 1, 1937. The location of the mill is on deep water and will contain its own docks and facilities for ocean shipment to other seaports in this and foreign countries.

Savannah, Ga., was selected as the site for the kraft mill of the Union Bag & Paper Corp. The chemical recovery department is shown



Maryland and Kentucky have come in for the lion's share of new distilleries. The Calvert Distillery Co. near Baltimore is completing a $1,000,000 addition to its plant

The West Virginia Pulp & Paper Co. chose property formerly belonging to the U. S. Ordnance Department at North Charleston, S. C., for the site of its new $5,000,000 kraft mill. The initial capacity of the mill will be 250 tons per day of unbleached pulp and kraft paper liners. At some future time it is expected that additions will be made in order to double the initial capacity of the mill. On November 1, when this mill was visited, steel work for the buildings was being erected. It is expected that the mill will be ready for operations in the Spring of 1937.

Next in geographical order is the Savannah, Ga., kraft pulp, paper and bag mill of the Union Bag and Paper Corp. The first unit of this mill was formally opened on October 1. The present capacity of the mill is 150 tons of unbleached pulp, 125 tons of bag and wrapping paper and 12,000,000 bags daily. In the past the company has purchased a substantial portion of its pulp requirements in Sweden.

The mill is located on a 370 acre tract of land near the Savannah River which provides water transportation for raw materials and products. The building is in the shape of an L, with the bag factory as one arm and the pulp and paper divisions stretching out over a quarter of a mile at right angles to the big plant. Second growth slash pine will be the principal raw material, but it has been said that the plant would also consume 20,000 tons of salt cake and 6,000 tons of lime.

A few weeks before the first unit was completed, Pres. Alexander Calder announced: "It has been apparent for some time that sooner or later we would require a second unit at Savannah. With this possibility in view the buildings at Savannah were made sufficiently large to house a second paper machine and to facilitate the installation of the necessary equipment. We have now decided to double our production of paper at Savannah and to make a surplus of approximately 25,000 tons of kraft pulp annually for shipment to our Hudson Falls mill. This decision has been made because of the constant increase in the consumption of kraft pulp, board, paper and bags during the past three years,—"

More recently, President Calder announced that construction of a third unit would start shortly. It will have a capacity of 40,000 tons of pulp, and will cost $3,500,000. It is estimated that the integration of the activities of the company in the South will result in savings of over $3,000,000 a year. This new unit will be completed late in 1937.

The Resin Products Co., a neighbor of the Union Bag organization, plans to construct a plant for the extraction of fatty substances from the pine wood. The cost of this plant will be about $100,000. Although fatty acids have been recovered from pine wood on a commercial scale in this country for many years only a very few companies have ever entered the field.

Georgia will be the location of a second large mill. At Brunswick work will be started as soon as the engineering plans can be completed for the kraft mill and bleaching plant of the Brunswick Pulp and Paper Co., jointly owned by the Scott Paper Co., and the Mead Corp. It will be located adjacent to the city limits near the site of the properties of the Southern Railway docks and eventually will consist of several units. The first unit will consist of a plant for the production of 150 tons of bleached and unbleached kraft pulps. The property on which the mill will be located extends for a distance of 1,500 ft. along the Turtle River, accessible to channels of a depth of 30 ft. and suitable for ocean-going vessels. The present plans do not provide for manufacture of the finished product at the Brunswick mill, but it has been stated that the pulp will be shipped to the other mills of the two companies; however, it is a possibility that a paper mill may be considered for the Georgia site at a later date. The Scott and Mead organizations have been among the largest importers of pulp in the country.

Leaving the Atlantic Coast and going over to the Gulf, the site of the proposed kraft pulp and paper mill of the Container Corp. of America, is found at Fernandina, Fla. The mill will ship its product to the company's converting mills in other parts of the United States. It will be composed of several large units, with power house, pumping station and the like. It is estimated that the mill and equipment will cost about $6,000,000.

The St. Joe Paper Co. was organized under direction of the Almours Securities, Inc., (the Alfred I. du Pont estate) to build a kraft mill at Port St. Joe, Fla. The mill will consist of a number of one and multi-story units, to be equipped for the production of kraft liner board and like products, with initial capacity of 350 tons per day. It was stated at the time of the announcement of the building program that the company proposes to

establish a division for extensive experimentation in newsprint production from Southern pines. The Mead Corp. is interested in the project, and operation and management of the company will be under its direction. In addition to large timber resources in Gulf, Liberty, Franklin and other counties, totalling about 200,000 acres in all, the Almours organization also owns 500,000 acres in Northwest Florida.

Pasadena, near Houston, Tex., is the site of the new kraft pulp mill of the Champion Paper and Fibre Co. The first unit of the project is expected to be ready for operations about February 1. The plant consists of a group of large buildings for production of long-fiber bleached and semi-bleached sulphate pulp. The initial capacity will be 150 tons.

The company has arranged for a pulp wood supply for the mill and has placed contracts for purchase of second growth yellow pine on a tract of about 700,000 acres of land in several counties in Eastern Texas. Contracts call for a maximum of 10,000 cords of pine wood, cut from trees not less than 5 in. in diameter.

The only one of the new pulp and paper mills that will not be located on tide water is being constructed at Crossett, Ark. This $4,000,000 pulp and paper mill of the Crossett Lumber Co. will probably be placed in operation early in 1937. It will have an initial capacity of 150 tons of kraft pulp per day; 100 tons will be converted into wrapping paper and bags. The mill will depend for its water upon eight artesian wells with a total capacity of 6,000,000 gal. per day.

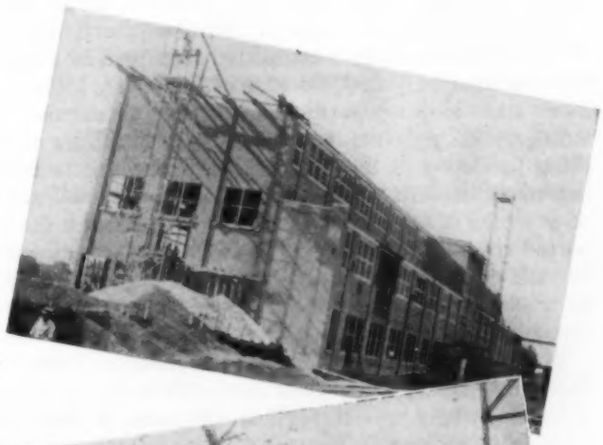
Unlike the alkali industry, kraft pulp and paper is not new to the Southern States. Most of our kraft pulp previous to this development had been made in that area. In 1934, the Southern mills had a capacity of 3,500 tons of pulp of this type, while the ten new kraft mills will bring the total up to 6,600 tons a day or 2,310,000 tons a year.

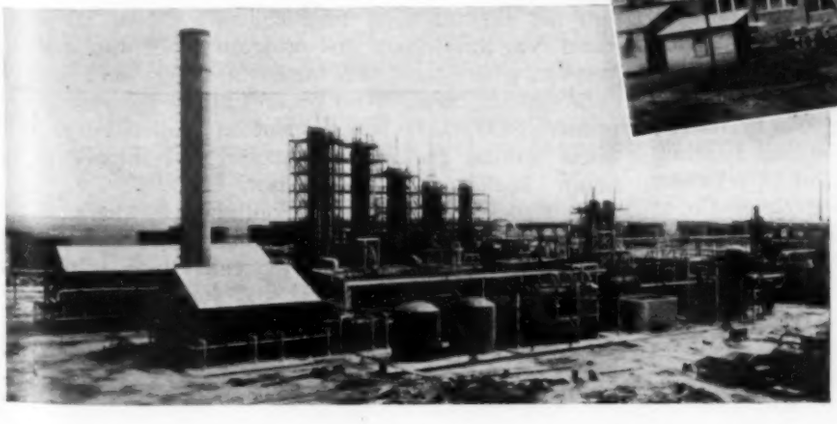
The additional kraft pulp will be used by two or three corporations to replace the supplies previously imported for conversion into bags, toilet tissue and other products. In another case the new mill will simply replace a high-cost plant of the same company in the East. At the same time the products of the other mills will be employed to meet the increased demand for both unbleached and bleached kraft papers.

Research work that has been done by many investigators during recent years has resulted in a bleached kraft paper that is a satisfactory substitute for sulphite for many applications. And indications are that before long bleached kraft will attract an important share of the market for fine papers.

Several of the older mills in the South are bleaching a portion of their output and some of the new mills are planning to go even further along this line. It is interesting in this connection to note that the Houston kraft mill of the Champion organization will produce fully bleached pulp from Southern pine.

Both the Georgia Pulp and Paper Laboratory at Savannah and the State Experiment Station of the University System of Georgia at Atlanta have made investigations to determine whether rayon can be made from Southern pine (*Chem. & Met.* vol. 42, p. 486, 1935). Recently Dr. Charles H. Herty has called attention to the increasing possibilities of making rayon from slash, loblolly and other Southern pines. He reported not long ago that one of the largest rayon producers had made a run of some sulphite pulp made from these pines quite successfully.





Top—Houston, Tex., kraft pulp mill of Champion Paper & Fibre Co. Machine room is shown. Center—Crossett Lumber Co.'s pulp mill is being constructed at Crossett, Ark. Diffuser, digester, evaporator and switch building is shown. Also outside black liquor storage tanks. Bottom—Pan American Petroleum and Transport Co.'s new refinery at Texas City, Tex.

Some idea of what this development may mean to the pulp industry of the South may be obtained from the fact that 400,000 tons of bleached sulphite pulp was consumed by the rayon industry in 1935. The increase in consumption of this type of pulp, according to reports, is between 20 and 25 per cent each year, and the peak of the rayon production is not yet in sight. As 60 per cent of the rayon is made in the South, it is natural to expect that these plants will draw largely upon the southern market for their raw material. The Southern rayon industry is steadily expanding. The du Pont Rayon Co. recently invested $800,000 in plant expansion at Amphill, (Richmond) Va.; the Celanese Corp. of America has put $150,000 into the Cumberland, Md., mill, and the Tubize Chatillon Corp. a like amount into its Hopewell, Va., plant for additions to its rayon dye works. This last organization is also spending $2,800,000 for the purpose of increasing the capacity of its viscose rayon department at Rome, Ga., and the Viscose Co. has announced it has acquired property at Front Royal, Va., on which it plans to build a large rayon mill.

This vast expansion in the pulp and paper industry has another important significance. It will require large tonnages of chemicals. Some of the pulp is already being bleached; but if the entire output should be bleached, which may take some time to accomplish, there will be a market for 270,000 tons of chlorine bleach per year. When the new mills are completed there will be a market for approximately 250,000 tons of salt cake, 150 tons of lime and large quantities of other chemicals. And strangely enough the volume of the chemicals that is being produced in the neighborhood of the new mills is extremely limited. While a comparatively small amount of salt cake is produced in Louisiana, much of it is transported from distant points. The vastly increased demand for salt cake may encourage the development of methods of production on an economical basis nearer the points of consumption.

Much the same situation exists in chlorine. Heretofore the South has had to depend on the East for its chlorine. Several months ago the Allied Chemical & Dye Corp. completed a plant at Hopewell, Va., for the production of this important chemical without the necessity of adding to the country's volume of caustic soda. Some shipments have been made but it is understood that operations are not yet on a commercial scale. The Advance Bag and Paper Co. at Advance, La., is installing cells for the purpose of making its chlorine requirements, and Champion Paper & Fibre Co. is installing a cell plant for the production of chlorine at the new Pasadena mill. It will probably have a capacity of 20 tons of chlorine per day.

Considerable attention is being given the Southwest as a result of the large pulp and paper plant, the tremendously important expansion program of the Pan American Petroleum & Transport Co. at Texas City, where some of the largest oil refining units in the world are now being installed, and the expansion of Magnolia Petroleum Co. at Beaumont; of the Texas Co. and the Gulf Refining Co. at Port Arthur, the Shell Petroleum Corp., the Crown Petroleum Co., and the Eastern States Petroleum Co. at Houston, and many others. All of these plants will add almost staggering totals to the amount of new business now being done in the Southwest.

With the end of prohibition and the return of distilled liquors Maryland and Kentucky have come in for the "lion's share" of the construction program. While construction started several years ago, it apparently has not as yet caught up with the demand of the American people for distilled liquors. In the last two years alone $7,700,000 have been invested in distilleries. Although they dot the Kentucky countryside, there are several important centers of concentration. Louisville is the location of such expansion programs as that of the $2,000,000 Seagram Distillery Co., the $500,000 of National Distillers Products Co. and the $200,000 of Old Kentucky Distilling Co. Frankfort boasts of the $1,000,000 additional investment of Frankfort Distilleries, the $125,000 more that has been spent by Kent Taylor Distilling Co., $100,000 by Kennebec Distillery Co. and $40,000 by Tom Bixler Distillery Co. On the other hand the industry in Maryland is concentrated in and around Baltimore where the great plant of the Calvert Distilling Co. is completing a $1,000,000 addition, the Baltimore Pure Rye Distillery Co. is enlarging its facilities as are the James Distillery Inc., the Olde Tyme Distillers, the Wight Distillery Co., and others.

The ten states of the deep South annually consume $30,000,000 worth of glass products. While there are a few glass producers in these states, much of this amount is spent for glass made in other states. Perhaps this situation has had something to do with the investment of several millions of dollars in new plants in the South. The Pittsburgh Plate Glass Co. is constructing a $2,000,000 addition to its plant at Crystal City, Mo., and is investing $500,000 for modernization and expansion at Henryetta, Okla., Owens Illinois Glass Co. has appropriated $400,000 for like purposes at its Baltimore plant and according to a recent announcement C. W. Meyer is planning a $2,000,000 glass plant at Stone Mountain, Ga.

On October 1 ground was broken for the E. I. du Pont de Nemours & Co.'s $2,800,000 plant for the production of tetraethyl lead for Ethyl gasoline at Baton Rouge, La. At the annual meeting of stockholders of the Union Carbide & Carbon Corp., last Spring, President Jesse Ricks declared that his corporation had set aside $7,000,000 for construction of a new chemicals plant in the Southwest, as yet unlocated. Monsanto Chemical Co. is building an electric furnace phosphoric acid plant at Columbia, Tenn., which will cost in excess of $2,000,000. The Tennessee, Coal, Iron & Railroad Co. is building 73 coke ovens at a cost of $2,000,000 at Fairchild, Ala. The Universal Atlas Portland Cement Co. is spending $1,500,000 for mill addition at Birmingham, Ala. Theodore Swann is completing a plant for the production of menthol and other chemical specialties in Birmingham at a probable cost of $1,000,000. The du Ponts have put another $2,000,000 into the expansion of their cellophane plant at Richmond, Va., and have a vast program under way at Belle, W. Va., where their new methyl methacrylate plastic is to be manufactured. And Union Carbide has just appropriated $2,000,000 for a plant at Catlettsburg, Ky., where natural gas will be liquefied and shipped to its South Charleston, W. Va., plant.

So it goes—not only in the South but elsewhere. From these indications it is evident that chemical engineers in the process industries are extremely busy translating into brick and mortar, stone and steel, the depression achievements of laboratory researches.

Will Chemical Engineering Solve Germany's Problems?

By Dr. Ing. OTTO FUCHS
Professor of Chemical Engineering, University of Darmstadt, Germany

ONE of the principal problems for German industries during the next four years will be, according to the "Proclamation" at Nürnberg, to manufacture all of those imported products which might be manufactured in part or wholly from German sources of raw materials. First and foremost, this will be a monstrous task for the chemical industries. In fact the present German situation resembles somewhat that existing in the United States during the last years of the War and the years which followed it. Your problem then was to manufacture industrial products on a larger scale than ever before, by larger plants than ever before and with a better economic efficiency than ever before. It is well known, that it was exactly that situation which brought about the rapid development of both the science and practice of chemical engineering in the United States, and I believe that a similar development, perhaps still more accelerated, may be now expected in Germany.

Looking around for products which might be manufactured as far as possible from our own raw materials, I should mention motor fuels in the first place, for there is no doubt, that technical progress already achieved with this particular problem will allow us to expect its realization perhaps within less than the four years specified by Mr. Hitler.

Germany possesses rich deposits of coal as well as of lignite. The output in 1935 was 140,000,000 tons of coal and 147,000,000 tons of lignite. The 1935 balance for motor fuels and lubricating oils in Germany reads as follows:

	Total Consumption	German Production
Motor Spirit (including also benzene and anhydrous alcohol)	1,985,000	340,000 (Motor spirit) 320,000 (Benzene) 177,000 (Anh. alcohol)
Special blends (may include consumption for solvents, thinners, etc.)	135,000	
Gas Oil (kerosene)	880,000	about 50,000
Lubricating Oil	450,000	about 100,000
	3,450,000 tons	987,000 tons

According to these figures there has been produced by synthesis, by carbonization, by fermentation and from German wells nearly 30 per cent of the total supply. A year ago it seemed that the increased manufacture by synthesis could scarcely offset the increasing demand of the continuously rising number of motor cars. But meantime the completion of the large plants in the Ruhr district, in Central Germany and in Saxonia has so far advanced these sources as to secure an ever increasing share in the total consumption.

Of late, the trend of technical development is in favor of the process of F. Fischer and H. Tropsch. In this process blue water gas of a composition 2 H_2:CO, and extremely free from sulphur, combines at atmospheric pressure, at about 200 deg. C., to give a mixture of hydrocarbons containing, besides some gasoline and paraffin wax, about equal parts of motor spirit and of kerosene. The catalysts used are the metals of the iron group, preferably cobalt, on activating and stabilizing carriers containing silica or alumina. Though containing a certain amount of olefines, the motor spirit will require improvement of its octane number by mixing with benzene or any other fuel of high anti-knock value. On the other hand, kerosene consisting of paraffin hydrocarbons exclusively is of special value as a fuel for high speed diesel engines. The crude products of the process already excel in their high degree of purity; they are free of sulphur and of color and of a pleasant odor and are fairly stable. The yield of products obtained by one passage over the catalyst is at least 60 per cent of the gas, and progress is still being made in this direction.

Besides the Fischer-Tropsch process just described, I should mention hydrogenation under high pressure, such as is effected in Leuna and in Böhlen (near Leipzig) with tars from lignite, or with finely ground coal or lignite suspended in heavy oils.

Extraction of Coal

Extraction of coal by the process of Pott and Broche employing gradually increased pressure and temperature is being tested in a pilot plant. In contrast with earlier efforts of this kind, the present seeks a partial hydrogenation, and thereby stabilization, of the soluble portions of the coal by means of the hydrogen of the extracting oil, reacting under the special conditions of the new process.

There are also some additional measures which allow utilization or better exploitation of domestic sources of raw material. For example it has been found that tar oils from lignite containing phenols and of little value for high speed diesel engines may be greatly improved by the well-known extraction process (solvent refining) using liquid SO_2. Another problem just now under animated discussion in Germany is the low temperature carbonization of coal. The yield of oils and tar will be more than the double of the high temperature process and distillation of the tar yields more oils and less pitch. Two pilot installations constructed by Krupp and Lurgi are in successful operation, and the proposition has been suggested that existing gas-works should contribute to an increased output of raw materials for liquid fuel by erecting or annexing such carbonization units.

I feel that there is no reason for blaming Germany for vigorously attacking this problem. Natural deposits of liquid fuels are limited and the following generation must solve the problem either of how to restrict consumption or how to manufacture liquid fuels from solid ones. Under these circumstances what Germany is about to do in the matter of fundamental work may prove a benefit for other nations as well.

And beyond these considerations still another may be expressed as follows: The development of new sources of raw materials within one's own country is a more peaceful objective than any engagement in warlike preparations for securing over-sea fields.

25 Years of Chemical Engineering Progress in Filtration

By ARTHUR WRIGHT

Goslin-Birmingham Manufacturing Co., Inc., New York

JANUARY, 1937, marks the twenty-fifth anniversary of an address by Ernest J. Sweetland (see *Met. & Chem. Eng.*, Vol. 10, No. 2, Feb. 1912), which may well be regarded as the beginning of chemical engineering influence on filtration. His paper, presented before the New York Section of American Chemical Society, was entitled "Improvements in the Art of Filtration." Please note that he was not discussing improvements in filtration engineering or in the chemical engineering unit operation of filtration. Nor was he discussing the science of filtration. If such has developed during the past 25 years it is because we have progressed considerably in the better use of filters and their better performance as engineering tools.

Sweetland had some worthy contemporaries in those days. George Moore had developed his Moore filter and established the basis of the modern filter by his uninterrupted cake formation and its displacement wash. John Van Nostrand Dorr had already succeeded in developing his classifier and thickener—the performance of which greatly improved the filtration of cyanide pulp. David J. Kelly had made his contribution of a practical pressure leaf filter, the locking mechanisms of which will long remain as an ingenious mechanical innovation. Edwin Letts Oliver made Moore's idea a success in a continuous filter by his clever spiral winding of the drum and the development of a simple control valve. More names could be added to this list. But it is significant that so far only mining engineers have been mentioned. To mining engineering, therefore, goes the credit for genesis of the modern filter. Let chemical engineers appreciate the fact that this foundation had already been laid on which they could help in building the modern structure of filtration engineering.

Filtration was formerly defined and perhaps is still regarded by many laymen as the separation of solids of suspension from the liquor in which they are suspended. But the chemical engineer cannot be limited to such a definition. At least half of all the filters installed in process industries have, as their main purpose, the washing of soluble materials from deposited cake. Again a great many filters have as their primary purpose the discharge of a dewatered cake. Surely, then, the definition of filtration, if it is to be of value today, must be broadened to include all the manifold duties of the filter.

Separation of solids from liquids is one definition of clarification. When continuous filters must do the work of clarification, that is their main duty. No emphasis is put on washing out solubles or dewatering the cake. Instead, the greater part of the working arc of rotation —60 to 75 per cent—is provided for filtration. With a unit so designed, automatic clarification is a marked success and the high efficiency and economy of operation are among the major mechanical advances of recent times.

The chemical engineer's contribution to better filtration is principally in making "contrary" liquor filterable. Even the best designed and most painstakingly constructed filter cannot handle an unfilterable product. An imperfectly designed and haphazardly constructed machine may work satisfactorily with a properly conditioned product. Hence it is within the province of the chemical engineer to define the duty of the filter.

If the duty is to wash out solubles, then the clarification to a brilliant filtrate or the dewatering of the cake to a dry solid should be secondary to the main objective. Likewise, if the duty is dewatering the cake, the extraction of solubles should be a secondary objective and not allowed to obscure the main function of reducing the moisture content. Too many filters have been installed where the filter has been overloaded with excessive duties. If more than one objective is required, it will generally be found that two units working in series will prove the cheapest and most satisfactory installation.

There is, however, one duty common to every filter and its importance transcends all others, namely, discharge of the cake. If complete discharge of the cake is not obtained, the cloth clogs. The increased resistance to flow jeopardizes the percolation of the wash water through the cake and poor washing results. Then the dewatering effect of evacuating the liquid out of the voids in the cake is reduced and the moisture rises in the discharged cake. Obviously the capacity falls and unless the area provided is large, the desired output may not be obtained. Chemical engineers in working out the method of treatment must keep in mind that the cake must be dischargeable.

Fibrous Filter Aids Prove Valuable

In the work of conditioning liquors to approach the characteristics of free filtering material, the chemical engineer has had two principal methods of attack: (1) He could add a free filtering solid to overpower the contrary native solids or (2) he could flocculate the solids by chemical treatment. Much good work has been done along both lines but too seldom has the combination of these two methods been used.

The writer believes a larger measure of success is waiting those who will take this middle course. Those

Based on a paper entitled "Chemical Engineering Phases of Filtration," presented by the author before the Baltimore meeting of the American Institute of Chemical Engineers, Nov. 13, 1936.

chemical engineers who have adopted the use of fibrous filter aids are most enthusiastic. They obtain high rates of flow and, by recovering the fiber for reuse, they get remarkable economies. This is particularly true when using continuous clarifying filters.

There is a demand for a proper basis of comparing the operation of filters, often in different plants of the same company, and even of two makes of machines in the same factory. The writer applauds the efforts that have been made to define mathematical formulas that will apply to filtration. Unfortunately, most attempts to date have required the use of too many constants. The range of variation for the values of K has often limited the practical utility of such formulas.

But it may be that we are advancing to a point where comparisons will be possible on the basis of certain "common denominators." Cane-sugar refining offers an example but what is true in sugar is equally true of other industries. The difficulty in the past of coping with a weak structure of various flocs in modern filters has been a barrier to the widespread adoption of this means of reducing variables and assisting in getting "common denominators" for valid comparisons. But this difficulty vanishes when using a filter aid with the flocculent. This is especially true when the aid is a fibrous product with which a high capacity is obtainable and from which a brilliant filtrate results.

With vacuum filters in which the working pressure is below the point of vaporization of the hot liquor, the pressure is not sufficient to break down the structure of the floc. This low head of filtration has likewise proved valuable in retaining colloidal solids that under high pressures, as in pressure leaf filters, pass through as filtrate later to appear as solids of suspension, especially on cooling.

Even without adequate mathematical formulas, it is possible to make comparisons of filtration stations. This requires an experimental basis of determining operating efficiency as related to leaf test indication. A standard test leaf of the kind of filter being used and operated to parallel the cycle of the plant unit gives results which can be termed ideal. Plant operation is then referred to the capacity, or washing efficiency or dewatering effect of the test leaf in terms of percentage. In different plants where it may be difficult to test filtering characteristics of a certain material, the use of the test leaf reduces the interpolation necessary on this score and makes comparisons on the basis of a common denominator—percentage of efficiency.

Operating Kinks and Shortcuts

The chemical engineer has learned that aside from the condition of the material to be filtered, there are numerous small but important "tricks of the trade" that must be observed. He knows, for instance, that the feed to the filter should not be accompanied with large quantities of air; that the discharge of centrifugal pumps should not be throttled or else the excessive agitation will break up the agglomerates or chemical flocculents. He will avoid wide density variations by providing adequate temperature control and will maintain the pH constant at the value which he has determined will yield the best conditioned material. The advance in equipment for the recording of pH and control valves to maintain it constant are tools which the chemical engineer uses in maintaining efficient and economical operations.

In the beet-sugar industry continuous carbonation of the first carbonated juice depends upon maintaining the pH uniform by means of automatic control. In practice the nicety of operation levels off much of the variation that formerly tried the ingenuity and perseverance of operators using intermittent carbonation. In the same industry the extraction of sucrose from molasses by the well-known Steffen's process has always been a batch operation but recently this has been made continuous, again with a nicety of control that has enabled some plants to effect large economies.

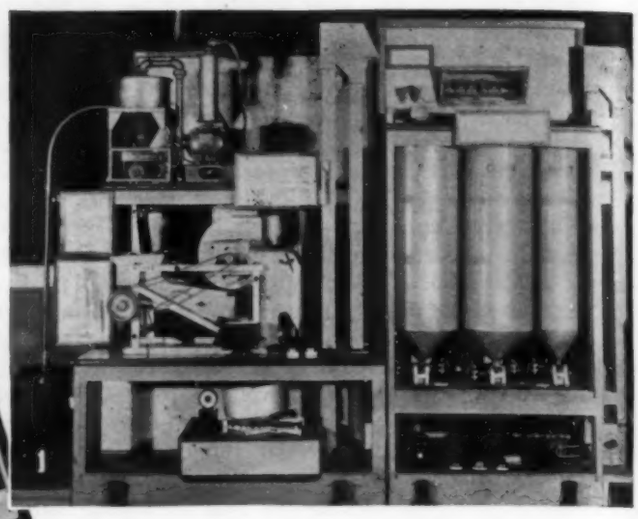
In working out this latter process there was a difficulty at first in an after-precipitation which clogged the filter medium. The plant was installed on the basis of decreasing tankage and increasing speed of transit of the liquor. To overcome the after filtration, it was first thought necessary to provide a time for this reaction but research proved that a more rapid circulation in the treatment unit quickened the complete reaction and after-precipitation is no longer a difficulty.

New Fields of Usefulness

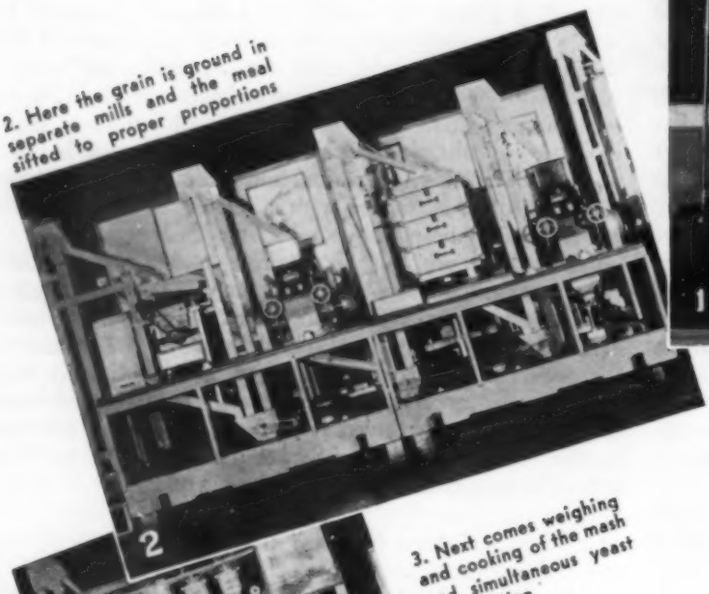
Advance in extracting wax from lubricating oil by the use of volatile solvents is another chemical engineering approach to better filtration, since the resulting wax crystals are much more easily filtered. The ability to install automatic filters for the old high-pressure recess type of filter presses is an advance achieved by chemical engineering.

Sewage disposal is rapidly becoming a chemical engineering function. Sanitarians are beginning to recognize the advantages of sludge dewatering resulting from the proper chemical conditioning for efficient filtration. The public is learning to depend more and more upon the control with which the chemical engineer treats raw sewage to produce a clarified effluent rather than relying upon the mass action of bacteria in biological purification processes. It is already recognized in some quarters and will be appreciated in still wider circles that plant wastes treated by chemical engineering processes can be rendered innocuous for discharge into waterways which provide at least 25 to 1 dilution irrespective of the amount of dissolved solids, just so long as the liquor is clear and approximately neutral in reaction.

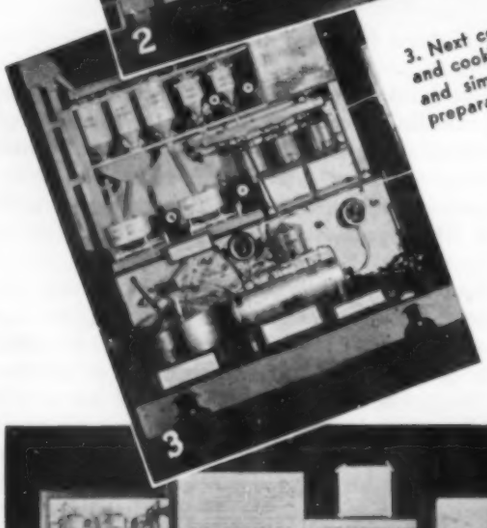
Filtration efficiencies are rising. Filtration costs are falling, but it can be well said that the field of useful service for filters on materials not now filtered is as great as all past applications put together. When we think of the liquid that is going over the weirs of settling tanks to be treated subsequently in evaporators or even marketed as finished products, when we note the large areas often required for settling operations that could be tremendously reduced if filters were economically applied, or when we think of stream pollution from factory wastes that could be eliminated by proper filtration, then we have some appreciation of the work still to be done by chemical engineers in developing a true science of filtration.



1. Grain from 24-in. freight car is unloaded pneumatically, cleaned of dust, automatically weighed, elevated and conveyed to storage hoppers



2. Here the grain is ground in separate mills and the meal sifted to proper proportions

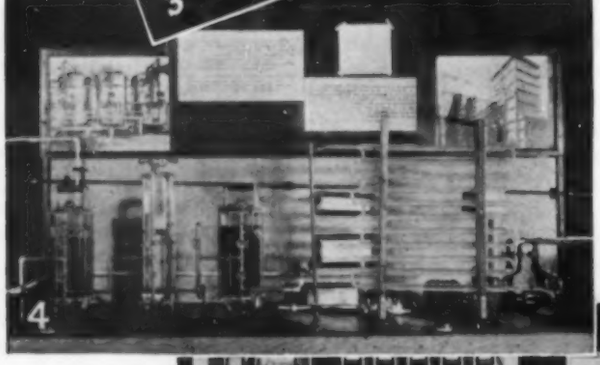


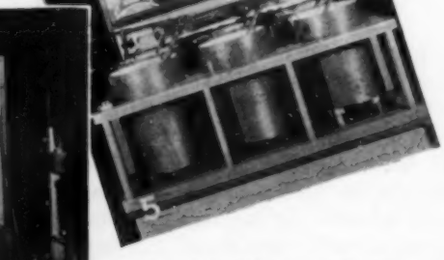
3. Next comes weighing and cooking of the mash and simultaneous yeast preparation

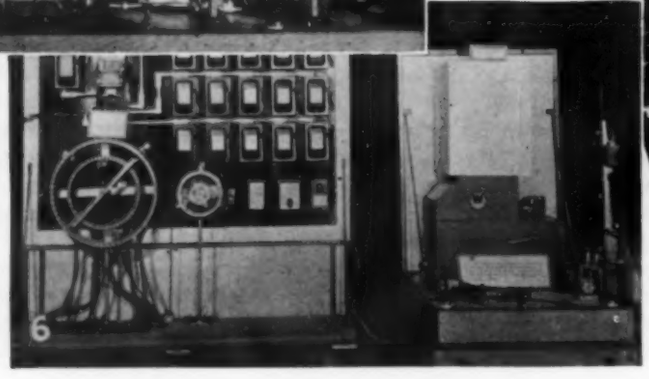
DRAMATIZING A PROCESS

A Miniature Model of

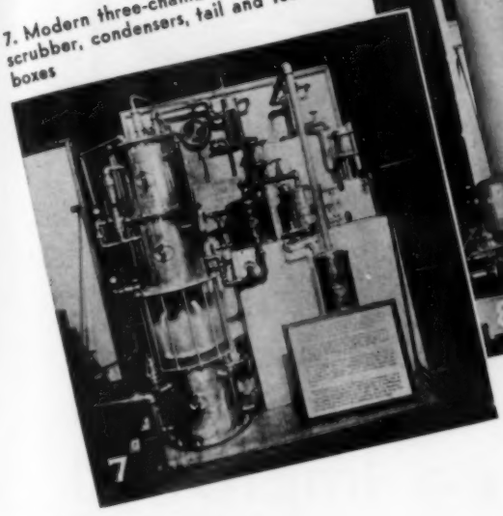
AT THE Great Lakes Exposition in Cleveland one of the most attractive industrial displays was this miniature distillery exhibited by the Distilled Spirits Institute, Inc. Occupying more than 200 lineal feet of frontage, the sequence of units shown in the accompanying illustrations traced manufacturing operations step by step from the unloading of the grain through to the final storage of the barreled beverages in the warehouses. Manufacturers of distillery equipment and machinery cooperated with the Institute's consulting exposition engi-



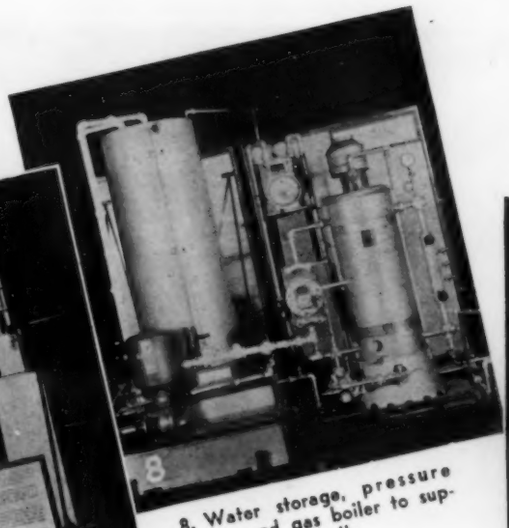




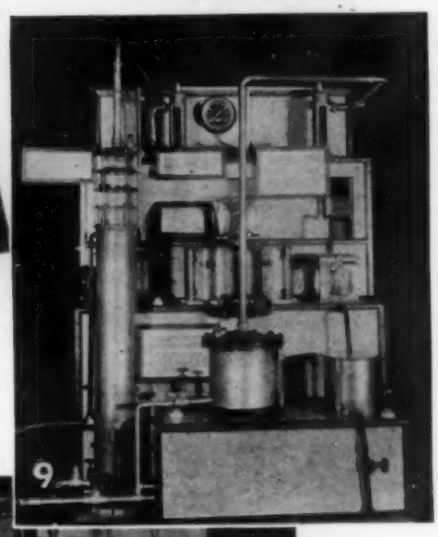
4, 5 and 6. Water purification, cooling and fermentation of mash, electrical controls and well where beer is stored to be pumped to stills as needed



7. Modern three-chamber rye still, scrubber, condensers, tail and test boxes



8. Water storage, pressure pump, and gas boiler to supply steam at 10 lb.



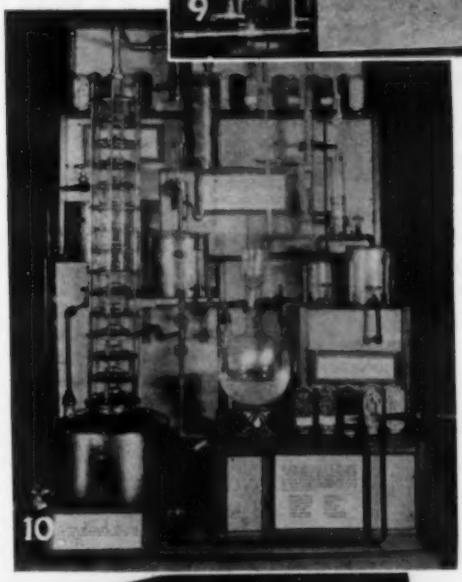
9. Continuous bourbon still, preheater, condensers, test boxes and doubling still unit

INDUSTRY

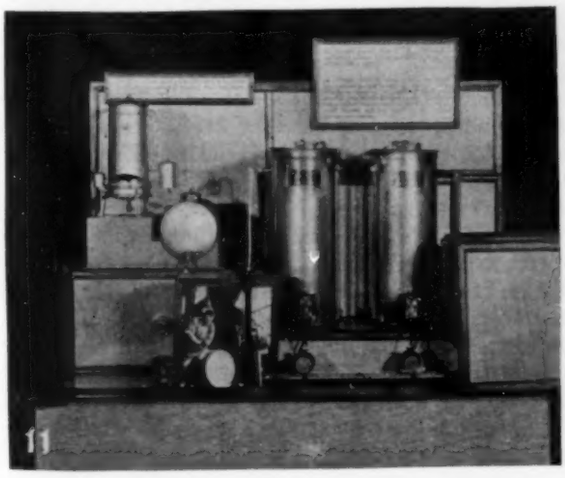
a Modern Distillery

neer, Wm. H. Pfau of New York, either by supplying working models or assisting in the design and construction of small-scale equipment.

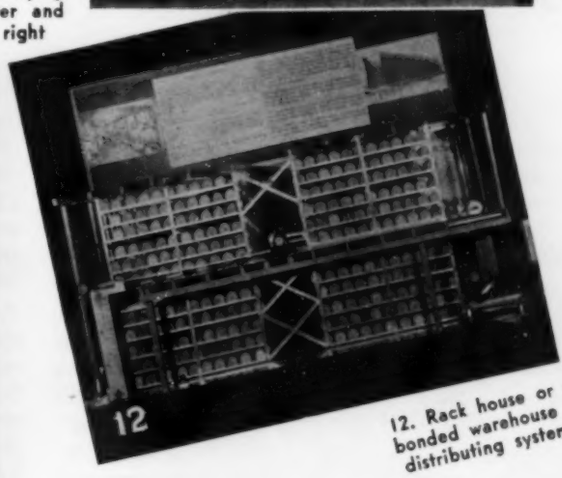
Such an exhibit of a comparatively complicated process industry suggests the educational possibilities in other mechanically operated models. What has been done in vividly dramatizing chemical manufacturing processes in the great industrial museum in Munich, Germany, is another example of this important trend toward visual education.



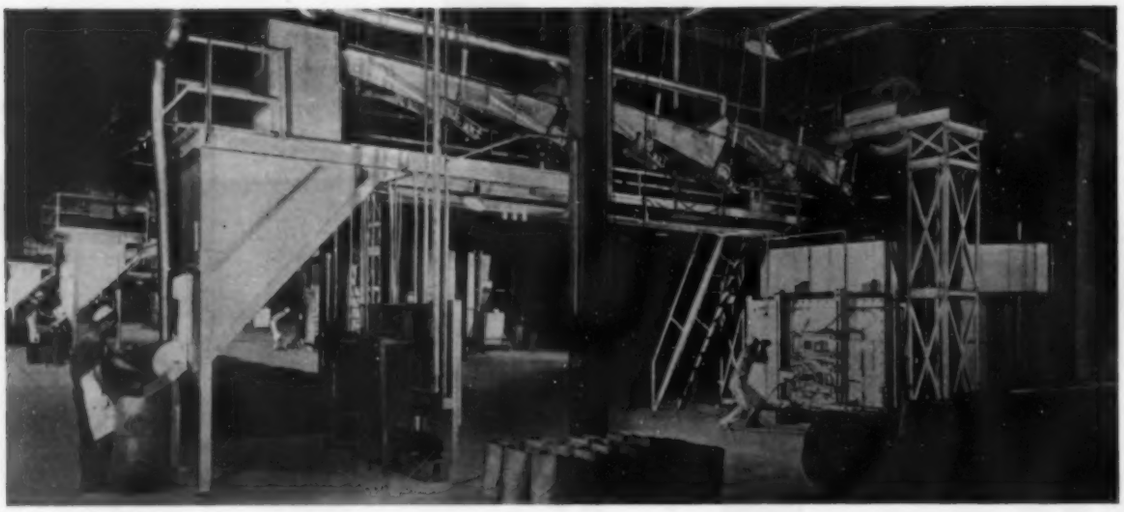
10. Spirits still and rectifying column, dephlegmater and condenser. Gin still at right



11. Water still and distilled water storage tank, cistern room and filling equipment



12. Rack house or storage bonded warehouse with barrel distributing system



Enamel Frit Manufacture Improved By Continuous Smelting

By THEODORE R. OLIVE
Associate Editor, Chem. & Met.

BETTER BUSINESS in the post-Depression years than in 1929 is an achievement not many industries can boast. Porcelain enameling, however, is one of the fortunate few, for a combination of circumstances including new trends in metal finishing, coupled with an eagerness to improve and forward the use of its product, has put the industry in an enviable position. Part of the credit is due to merchandising effort, part to research leading to a better understanding of enamels, and part to a scientific engineering approach to better production methods. A conspicuous example of the last is to be found in the recently announced continuous frit smelting process, developed over the last eight years by the Porcelain Enamel & Mfg. Co., of Baltimore.

Prior to this development, frit smelting was necessarily a small batch process, subject to the difficulties of control which affect such a method of production. But with the new continuous process, numerous improvements have become evident, including definite control of smelting time and temperature, greater uniformity of properties and of color, a better gloss and higher opacity of the product. In the way of operating advantages, the new equipment has increased output per unit of floor space and of labor and fuel cost. For the first time it has made possible the use of fully automatic control in this most important and critical step in enamel frit making.

Continuous smelting, of course, is not universally applicable, since the requirements for special frits produced in small quantities must still be met by batch smelting methods. But for the standard, large tonnage products, the new process appears to be ideal. It has, in fact, been used with complete success for three years, turning out the company's entire output of one product, and for one year in the production of another.

Since most chemical engineers are not particularly familiar with enamel frits and their application, it may be worthwhile to review the facts briefly before getting too far into our story. To begin with a definition, a frit is a granular glass-like material intermediate in properties between a glass and a porcelain body, designed to be fused onto a metal to produce a smooth, impervious, corrosion-resisting surface of any color desired. The frit itself does not ordinarily contain color—except the white, cobalt blue and black frits—the color being added by the enameler in his preparation of the frit for application to the metal. Frits are of several types, including both ground coats and cover coats, and vary in their composition depending on whether they are intended for use on sheet or cast iron. Various special types have been developed for use where particular properties are to be altered or emphasized.

In the early days of enameling, the enameler was also the frit maker. With a part of the industry this is still the case, although specialization has to a considerable extent separated the two functions, so that today the bulk of the frits produced are made in plants devoted exclusively to supplying the enameler's needs. Enamelers purchase their frits, wet mill them with color oxides, suspending agents and electrolytes, perhaps with additional opacifiers, producing a slip suitable for coating their ware prior to firing. Or for dry-process cast iron enameling, the frit may be dry milled without additions, simply

to be dusted on the hot ware which is then returned to the furnace.

Frit manufacture is an important use of considerable quantities of high-grade chemicals and minerals. In the Porcelain Enamel & Mfg. Co.'s plant more than 40 different raw materials, containing some 15 different elements, are required, including oxides, fluorides, carbonates, phosphates and nitrates. Refractory minerals are smelted with fluxes of various sorts to produce glasses which are modified by the addition of agents designed to bond the enamel to the metal surface and other materials to produce the desired opacity, gloss, color, hardness, expansion, and other properties.

Batches of 1,000 lb. are the basis of all Pemco operations, whether they are destined for the continuous or the batch smelting processes. In this size a batch is small enough for accurate proportioning of the raw materials, while at the same time it is not too large for convenient transportation between departments. All raw materials are received and stored at one end of the plant where they are kept in the original bags and barrels until used. Thus the plant avoids contamination. Batches are made up by weight on the basis of continual laboratory check-up of all raw materials, the batch container being lowered into a scale pit so that its top is flush with the floor, for easy filling. Such containers, which can be observed in two of the views reproduced here, are used for all interdepartment handling. They are constructed of sheet iron, with a drop bottom for discharging the batch, and can be transported either by lift truck or crane.

After it is made up the completed batch must be thoroughly mixed. For this purpose three mixers of two different types are in use, one a rotating drum of the concrete mixer type, the other two, horizontal mixing troughs with rotating paddles. It has been observed that the latter type is slightly more efficient in this service.

Smelting follows directly after the mixing. Before the development of the continuous process, six batch smelters were employed, including four 1,000-lb. rotaries and two 2,000-lb. reverberatory furnaces. This equipment is still available for special batches and will bear brief description to emphasize the achievements involved in the new continuous method.

City gas of 500 B.t.u. heating value is used in all smelting operations. The rotary smelters are refractory lined cylindrical shells mounted on trunnions and arranged for rotation for distributing the batch, and tipping for its discharge. The reverberatory type employs a flat, sloping hearth, the tap hole of which is plugged with clay during the smelting operation. Both types are lined with high-alumina, low-iron glass tank blocks.

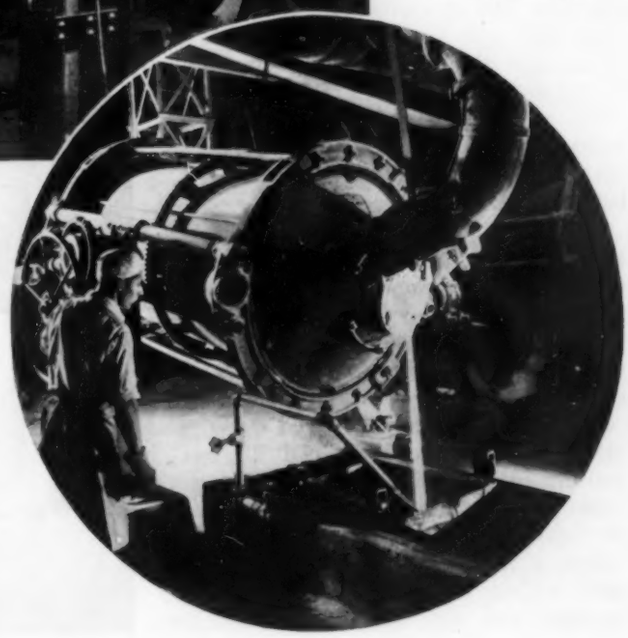
Charging is accomplished by means of portable motor-

On the opposite page are the three new continuous frit smelters developed by Pemco; the smelter is at the right, the dryer in the center and the bagging hopper at the left

Above, a charge of raw materials is being dropped into one of the trough type mixers

At the left are two rotaries and one reverberatory batch smelter; molten frit is running into the quenching tank of the reverberatory

Below, a rotary smelter is being discharged; note the perforated basket in the quenching pit



driven screw feeders, one of which is provided for each smelter. The batch container is elevated onto the feeder, the bottom opened and the feeder pushed forward on a track until the tip of the screw projects into the firing opening of the hot smelter. The screw is started, the charge fed in and the feeder withdrawn. The burner is then swung into the opening and the gas ignited. Smelting is completed at a temperature of about 2,000 deg. F., under control of an optical pyrometer, requiring a total of 1¾-2 hours.

The charge when it has been properly smelted must be quenched in water so as to shatter the mass into granular, friable particles that can later be ground without difficulty. For this purpose, a water pit is provided at each smelter, in which a perforated basket of aluminum or Monel metal is suspended. As the charge is run slowly into the water it is poled thoroughly by the operator to assist in preventing the formation of lumps. Then the basket is lifted from the tank and allowed to drain, after which its contents is fed through one of four direct-gas-fired rotary dryers. Frit enters the dryer with about 8 per cent moisture and is reduced to bone-dry. To avoid contamination the dryers are provided with porcelain block linings. Each is equipped with an induced draft fan and a dust separator. Frit discharges over a ½-in. mesh Monel metal screen and is lifted by an inclosed belt elevator to a Monel metal or stainless steel storage bin from which it is weighed directly into the paper bags in which it is shipped.

In contrast with this batch method just described, the continuous process gives the appearance of extreme simplicity. In 1928 the company first began its experiments on continuous equipment. Five years later the first production size continuous smelter was put into operation and this design, although successful, has since been materially modified and refined in two new smelters built in 1934 and 1936. At present, the original equipment is being converted to the same design that has been used for the two later smelters.

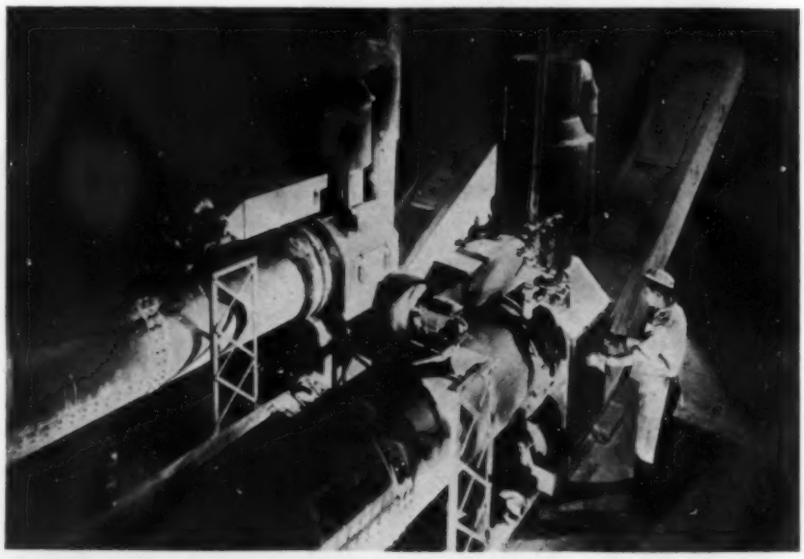
Fully automatic handling of materials, from the feed end of the smelter to the storage bin for the finished product, is an outstanding feature of the new equipment. Batch containers are brought to the machine on lift trucks, elevated above a hopper and dumped into it. A feed screw operated by a variable-speed drive continuously withdraws materials from this hopper and discharges onto the hearth of the smelter which is, in effect, a miniature continuous glass tank. Heat is supplied by city gas burners and the temperature held within 10 deg. F. by fully automatic temperature control secured through the use of a recording and controlling radiation pyrometer.

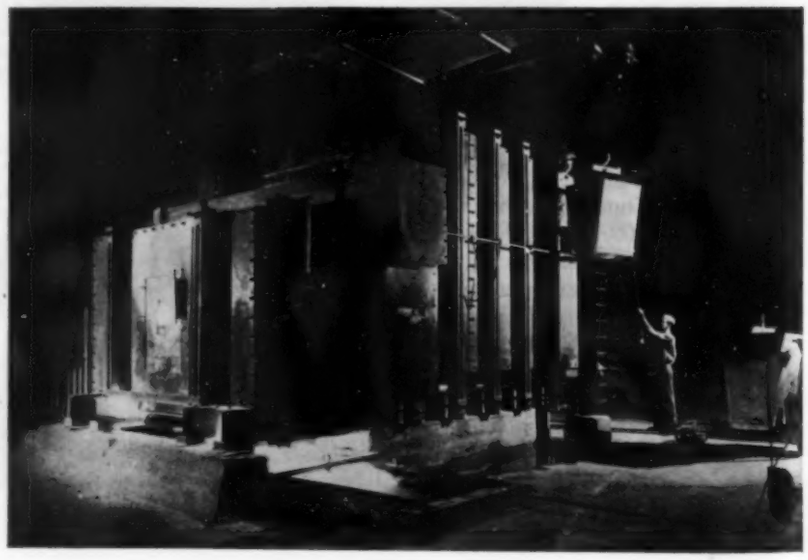
As it is smelted, the molten enamel flows slowly through the furnace and discharges in a thin stream into a deep water tank where it is quenched. An elevating device removes the frit from the tank and lifts it to a dryer placed high enough above the operating floor so that it can discharge directly into the finished frit storage bin. Two types of dryer have been tried in this service—a rotary dryer of the type used with the batch smelters, and a dryer made up of three sections of electrically vibrated conveyor with a gas flame placed directly beneath the metal conveyor troughs.

The foregoing has pictured briefly how porcelain enamels are produced in a plant employing the most modern production methods. Grateful acknowledgment is due to Pemco for the privilege of being the first to describe this development in print.

Discharge end of two of the rotary dryers used for batch-smelted frits

First successful type of continuous smelter, with operators preparing to dump raw materials into the feed hopper; the quenching pit is at the left





What Becomes of Chemical Engineers?

CHEMICAL ENGINEERS are concentrated mainly in private manufacturing industry, and the specific duties of most of them lie in plant operation. The proportion of men holding advanced engineering degrees is much greater among chemical engineers than among members of any of the other branches of the engineering profession. Engineers whose course of college specialization differed from their present class of work are less numerous in chemical engineering than in the engineering field as a whole. These are some of the facts developed in a survey undertaken in May 1935 by the U. S. Bureau of Labor Statistics at the request of the American Engineering Council.

The primary purpose of this survey, which covered all branches of the engineering profession, was to find out how engineers had fared during the depression. More specifically, its objectives were to determine the extent of unemployment, what fields of activity offered engineers the greatest job security, where they have been able to find substitute employment, and their compensation between 1929 and 1935. To provide a background for this information, so that general trends affecting the profession could more readily be determined, the survey was extended to include education and subsequent experience. Thus far, however, only the results on education, fields of activity and occupational functions have been made available.

A total of 52,589 engineers located in all parts of the country supplied the data for the survey. They were grouped into nine major professional classes, agricultural, architectural, ceramic, chemical, civil, electrical, industrial, mechanical, and mining and metallurgical.

Occupational distribution of engineers in the United States

Field of Activity	Chemical Engineers*	All Engineers
Manufacturing	56.5%	30.4%
Extractive Ind.	21.4	5.1
Personal Service**	9.4	11.6
Government	8.0	31.5
Public Utilities	3.2	11.8
Construction	1.5	9.6
		100.0
Functional Classification		
Operation	46.3%	24.2%
Design and Research	27.6	26.6
Teaching	6.8	5.9
Consulting	6.7	6.4
Administration	6.0	8.3
Construction	3.9	24.1
		100.0

*Includes chemical, ceramic, mining and metallurgical engineers.
**Includes publications, trade organizations, wholesale and retail establishments, transportation and miscellaneous

On the questions of field of activity and functional classification, only those who were employed in engineering pursuits as of December 31, 1934 were included. This number amounted to 34,457, of which 3,926 were listed as chemical, ceramic or mining and metallurgical engineers. Since these three classes are all more or less closely related, they have been grouped together in the accompanying chart as "chemical engineers."

Field of Activity and Functional Classification

The import of this analysis is that there are certain well-defined fields of activity for each of the professional classes. In the case of the combined group of "chemical engineers," the major field is manufacturing, with extractive industries as high as second place only because of the inclusion of mining and metallurgical engineers. Personal service, which ranks third, is a group of smaller fields which includes educational work, publications, professional and trade organizations, transportation, real estate, banking, insurance and wholesale and retail establishments.

If the ceramic, chemical and mining and metallurgical classes are considered separately, the distribution picture changes slightly in the two largest fields, manufacturing and extractive industries. The other four fields remain practically the same. Of the ceramic and chemical engineers, who are distributed almost identically in all fields, manufacturing accounts for 75 per cent and extractive industries for only 6.5 per cent. These figures are counterbalanced by those for the mining and metallurgical engineers, which show 47.3 per cent in extractive industries and only 27.7 per cent in manufacturing.

An interesting contrast is found in the percentages engaged in government work. Most of those men making up the 31.5 figure in the "all engineers" column, will be found in the agricultural, architectural and civil classes This combined group has 63 per cent of its total number in government work. All other classes, like chemical, have less than a 10 per cent representation in this field.

Functional classification may be more simply described as classification according to the kind of work done within the field of activity. For the chemical group, the two predominant functional fields are plant operation and design and research, with major emphasis on operation. A breakdown of the group into ceramic, chemical and mining and metallurgical engineers shows that the functional distribution of the individual classes does not vary appreciably from that of the group. Mining and metallurgical engineers have slightly more of their number in the smaller fields of consulting, teaching and

administration, but the order of importance is the same. Chemical engineers are a few per cent higher in design and research.

Educational Data

A summary of the educational data made available by the survey is presented in the following table, in which the column headed "chemical engineers" does not include ceramic and mining and metallurgical engineers:

	Chemical Engineers	All Engineers
	(Per Cent)	
Bachelor's degree in engineering	74.4	72.9
Master's degree in engineering	10.9	5.2
Doctor's degree in engineering	2.9	0.6
Non-engineering graduates	6.0	2.5
College engineering course unfinished	4.3	10.8
Non-collegiate technical-school engineers	0.6	5.1
Secondary-school engineers	0.1	1.8
All others	0.8	1.1
	100.0	100.0
Degree in same branch of engineering as present field of work	84.1	70.3
Degree in branch of engineering different from present field of work	4.1	8.4
No engineering degree	11.8	21.3
	100.0	100.0

There is a distinct prevalence of first degrees in engineering in all of the professional classes, which indicates that this much formal training is almost a prerequisite today for entry into any of the engineering fields. However, among chemical engineers, 95 per cent of these first degrees were in chemical engineering, while for all engineers, only 88 per cent were in the field of present specialization. This does not mean that there is less tendency among chemical engineers to transfer to other classes of engineering—in fact, there are indications quite the opposite—but it does show that other engineers are not changing over to chemical engineering work.

The importance of specialized training for chemical engineering is further emphasized by the small proportion of men in this class who are without a college engineering degree. Secondary-school or non-collegiate technical-school engineers are practically non-existent in the chemical engineering field, and they do not form a large group in the engineering profession as a whole.

Throughout the entire array of educational data supplied by this survey, the general indications are that formal education plays a more important part in the training of a chemical engineer than it does in the training of a man for any other of the engineering branches. The chemical engineer spends a greater average number of years in college than do any of his professional brothers.

Who Makes Chemical Engineers?

Editor's Note: The answer to this question was so ably presented by Harry A. Curtis, Chairman, A.I.Ch.E. Committee on Chemical Engineering Education, in a recent article in the A.I.Ch.E. Student Bulletin, that the editors of Chem. & Met. believe it will be of interest to others in the profession. Excerpts from the article are presented here.

A CHEMICAL ENGINEER makes himself. Only by his own conscious efforts, continued over a period of years much longer than he spends in college, may he finally become an honest-to-goodness chemical engineer.

Those of us who have spent years in the classroom and laboratory working with would-be chemical engineers, know very well that a student is finally "on the way" when he takes his own education in hand. Once he really gets a grip on the idea that, after all, he is doing the job of educating himself for his chosen profession, a remarkable change comes over him. He is no longer a passive listener to a few more or less competent instructors, or a casual reader of text-book assignments. He awakens to the fact that there are chemical engineering journals where the science and practice of chemical engineering as it now exists and develops are recorded by the men who are actually doing things; that there are catalogs and advertisements of companies who make chemical engineering equipment; that there are chemical expositions, and meetings of the American Institute of Chemical Engineers, and visits to chemical plants. From all of these he takes what he can. He realizes that he must learn the fundamental sciences well—chemistry, mathematics, physics, and their applications in his field of engineering—for any practicing chemical engineer will tell him that only thus may he hope to become a successful member of the profession. But he learns many other things than these. He learns how things are done in engineering and why. He discovers that almost every practical engineering job involves choosing amongst several alternative methods of procedure, a selecting of equipment from a wide variety available, a balancing of effects, an adjusting of a complex set of interrelated factors in such a way as give the most economic result.

And as he comes to see clearly what chemical engineering really is, he sees also what he should do about the education of that would-be chemical engineer—himself.

The few years of college are gone before this would-be chemical engineer has had time to do more than make a fair beginning on his job of educating himself. He must then earn a living, and he may want to take him a wife, and he certainly will find many things interfering with his most important task, namely, the continuing of his education. But one thing is as sure as sunrise, to-wit: that if earning his living, poker games, movies, marrying and raising kids, or staying single and raising Cain, or anything else under the sun causes him to forget the fact that he must somehow continue to get an education, he is doomed. He will settle down into a more or less comfortable rut; he will do what other engineers direct him to do as long as he stays in the profession. A man may fail in college courses and this usually eliminates him as a potential chemical engineer; he may pass his college courses successfully and within the next five years eliminate himself just as effectively.

T.V.A. Estimates Favorable Costs for Concentrated Superphosphate—II

By HARRY A. CURTIS, ARTHUR M. MILLER and J. N. JUNKINS

Tennessee Valley Authority, Knoxville, Tenn., and Wilson Dam, Ala.

IN THREE ARTICLES appearing in *Chem. & Met.* in 1935 and 1936, the Tennessee Valley Authority has reported on its progress in producing phosphoric acid and concentrated superphosphate by the electric furnace method. The present article, the first half of which appeared in our November issue, presents a detailed estimate of the cost of producing such superphosphate in a larger plant than that used by the T.V.A. In November the cost and specifications of the buildings and equipment were given, together with the anticipated annual depreciation. This concluding section of the article details materials, power and miscellaneous costs, summarizing and commenting on the total expected production costs.—Editors.

Costs of Raw Materials

Phosphate Rock—Phosphate rock, washed, dried and screened to proper size for furnace use, has been offered T.V.A. on competitive bids at $4 per short ton for 72 per cent B.P.L. grade, f.o.b. origin in middle Tennessee. These offers were not accepted because higher grade rock at less cost was being produced in mining operations carried on for T.V.A. under contract.

For the present purpose, it will be assumed that phosphate rock of the grade indicated is purchased at $4 per short ton. The freight rate to Sheffield, Ala., is $1.47. This gives a delivered price of $5.47 for phosphate rock. (At present there is in effect an emergency increase in freight rates which amounts to an increase of 0.11 cents per ton. The regular rate becomes effective again on December 31, 1936, unless a further extension of the emergency rate is made.)

Coke—The T.V.A. purchases coke breeze at Birmingham, at $1.50 per short ton. The commercial freight rate (not Government rate) from Birmingham to Sheffield is $1.92, making a cost of $3.42 per ton f.o.b. works. There is a loss of about 15 per cent in drying this coke breeze, which increases the cost to $4.024 per short ton.

Silica Pebble—Silica pebble, cleaned and of proper size for furnace use is purchased at Iuka, Miss., for $0.60 per ton. The freight to Sheffield, Ala., is $0.40, giving a delivered cost of $1 per short ton.

Coal—Coal is purchased by T.V.A. at Nauvoo, Ala., for an average price of $2.39 per ton. The commercial freight to Sheffield, Ala., is $1, giving an f.o.b. works cost of $3.39 per ton.

The annual production of the plant must, of course, be kept as high as possible. It is not proper, however, to assume continuous operation at full capacity. Minor emergency repairs must be made frequently, but these seldom require more than a few hours. It has been stated previously that, in actual operation, power can be kept on a furnace for 98 per cent of the elapsed time during a month. This allows about 14 hours a month for minor repairs on each furnace. In other parts of the plant, storage has been provided for raw materials, for prepared raw materials, including phosphate fines and phosphate dust, and for phosphoric acid. These storage facilities permit interruption of manufacturing operations for minor repairs and there is reserve capacity in all units sufficient to take care of the accumulations of materials during the short interruptions.

Major repairs are a more serious matter. Operating experience indicates that there will be no difficulty in keeping an electric furnace on the line for at least 11 consecutive months without replacement of furnace lining.

The electric power rate schedule also has a bearing on the problem. It is desirable to use a maximum of secondary power during the 300 days that it is available. This indicates that major repairs, such as those on furnace linings, should be undertaken during the time when only primary power is available.

Since some assumption as to operating schedule is necessary, and in practice there will actually be a period when one or more furnaces will be idle, it will be assumed that four furnaces will be on the line 98 per cent of the elapsed time for 300 days of the year, and two furnaces on the line for 98 per cent of the elapsed time during the other 65 days of the year. On the basis of these assumptions the quantities of raw materials and their costs are as in Table IV.

Electric Power Rates

It is assumed that the plant is located in the vicinity of Wilson Dam so that power may be had at the busbar of the power station there. A load factor of 85 per cent will be assumed, and a total demand of 24,000 kw. with a contract demand of 12,000 kw.

An electric furnace plant of the kind under considera-

Table IV—Summary of Raw Material Costs

	Furnace Rock	Coke	Silica Pebble	Phosphate Dust	Coal
Delivered, cost per ton	$5.47	$4.024 [4]	$1.00	$5.47	$3.39
Tons per day [1]	302.933	55.91	89.6	106.4	1.7
Tons per 300 days [2]	90,880	16,773	26,880	31,920	510
Tons per 65 days [3]	9,845	1,817	2,912	3,458	55
Tons per year	100,725	18,590	29,792	35,378	565
Cost per year	$550,966	$74,806	$29,792	$193,518	$1,915

[1] Four furnaces; [2] using four furnaces; [3] using two furnaces; [4] cost includes drying.

Table V—Calculation of Monthly and Annual Power Bills

(Assuming 300 days as 10 months and 65 days as two months)

Monthly Bill, 300-Day Period

100,000 kw.-hr. at $0.0036	$ 360
200,000 kw.-hr. at 0.0027	540
700,000 kw.-hr. at 0.00225	1,575
7,640,000 kw.-hr. at 0.0018	13,752
8,074,880 kw.-hr' at 0.00135	10,901
16,714,880 kw.-hr	$ 27,128
Demand: 12,000 x 0.81	9,720
Total	$ 36,848
Cost for 10 months	$368,480

Monthly Bill, 65-Day Period

100,000 kw.-hr. at $0.0036	$ 360
200,000 kw.-hr. at 0.0027	540
700,000 kw.-hr. at 0.00225	1,575
3,320,000 kw.-hr. at 0.0018	5,976
4,037,440 kw.-hr. at 0.00135	5,451
8,357,440 kw.-hr	$ 13,902
Demand: 12,000 x 0.81	9,720
Total	$ 23,622
Cost for 2 months	$ 47,244
Annual power cost	$415,724

tion may contract for power under the T.V.A. rate schedule for a combination of primary and secondary non-transmitted power. This schedule is shown in the accompanying small type.

Since power bills under the rates schedule quoted below are on a monthly basis it is necessary to calculate the monthly costs when four furnaces and when two furnaces are in operation. With four furnaces a plant demand of 24,000 kw. will be assumed, and a demand of 12,000 kw. when only two furnaces are in operation. (It will be noted that because the contract demand must be 12,000 kw. to carry the two furnaces during the 2-months period, whereas the total demand during the 10-months period is only 24,000 kw., no advantage may be taken of the 35 per cent demand clause in the power rate schedule.

These monthly power costs are calculated in Table V. Calculations are based on the fact that four electric furnaces each drawing 5,330 kw. during 98 per cent of the time of a 30-day month will use 15,043,392 kw.-hr. If the furnaces use 90 per cent of the total power, then the consumption in the whole plant is 16,714,880 kw.-hr.

Supervision, Labor and Maintenance Materials

Costs for supervision and labor are itemized in Table VI. They are based on the assumptions that every employee in the plant will be allowed two weeks vacation with pay and that the working week for hourly employees will be 40 hours.

The actual cost per ton of superphosphate of materials and supplies for repairs and maintenance for the T.V.A. two-furnace plant for the months of February, March, and April, 1936, during which 11,539 tons of superphosphate was produced, was $0.1852 for factory supplies and $0.4849 for maintenance materials, a total of $0.6701 per ton. This, however, did not include furnace relining. It is likely that continued experience with furnace lining will eventually develop a lining that will last more than a year, but, to be conservative, it is assumed that all four furnaces must be lined below the slag level each year. This would increase the above figure to $0.803 per ton of superphosphate produced, and to be still further conservative, a cost of $0.90 per ton of superphosphate produced will be used in the present study. This is $1.79 per ton of available P_2O_5.

Miscellaneous Items of Cost

First Aid—An allowance of 2 per cent of the gross labor cost has been made for this item. This is a total of $4,960 per year, which is enough for the usual first aid service and incidental medical care in view of the medical care available under the Compensation Insurance carried.

Storeroom Service—It happens that storeroom service at the T.V.A. plant costs $0.04 per ton of superphosphate produced. This cost has been doubled for the purpose of the present study, giving an annual sum of $6,246 for this purpose.

Water—Because of conditions under which the T.V.A. plant is operated, the water requirement of the plant is not accurately known. An allowance of $0.20 per ton of superphosphate has been made, this permitting an annual water bill of $15,614.

Electrodes—This cost is accurately known. The average consumption of two furnaces for a 3-months operating period was 23 lb. per pound of P_2O_5 in the rock charged to the furnace. The electrodes cost $0.0667 per pound. This gives an annual cost of $154,522 for electrodes.

Insurance—The plant under consideration is of fireproof construction with the exception of the office and laboratory building. There is no occasion for carrying fire insurance on the plant itself. The insurance on the office and laboratory is a negligible sum in the present study.

Workmen's compensation insurance is taken at 2 per cent of the total payroll, or $4,960 per year.

T.V.A. Power Schedule Applicable to Proposed Plant

Demand Charge—For firm non-transmitted power delivered at the switchboard of the Authority's hydroelectric generating plants, $0.81 per kw. of demand per month.

For secondary non-transmitted power delivered at the switchboard of the Authority's hydroelectric generating plants available to customers three hundred (300) days, to be selected by the Authority, out of each successive twelve-month period, no demand charge.

Energy Charge—

First 100,000 kw.-hr. consumed per month at 3.6 mills per kw.-hr.

Next 200,000 kw.-hr. consumed per month at 2.7 mills per kw.-hr.

Next 700,000 kw.-hr. consumed per month at 2.25 mills per kw.-hr.

Excess over 1,000,000 kw.-hr. consumed per month at 1.8 mills per kw.-hr.

Charge for energy in excess of 360 times the total measured demand shall be subjected to a reduction of 0.45 mills per kw.-hr. from the otherwise applicable rate. It is understood, however, that there shall be no energy charge except to the extent that energy is actually consumed by customer.

Determination of Demand—Demand measurement shall be made by suitable instruments at the point of delivery. Total measured demand for any month shall be defined as the highest integrated simultaneous load during any sixty (60) consecutive minute period during the month for which determination is made.

For periods during which secondary power is not available, firm demand shall be taken as 100 per cent of the total measured demand, which shall not exceed the contract demand.

For months during which secondary power is available, firm demand shall be taken as 35 per cent of the total measured demand. Secondary demand shall be taken as the difference between total measured demand and firm demand. During any fractional month for which secondary demand charges apply such charges shall be prorated.

Adjustment of Demand Charge for Power Factor—The customer's demand shall, whenever the normal power factor is less than 85 per cent, be determined upon the basis of 85 per cent power factor, that is, whenever said normal power factor is less than 85 per cent the demand shall be taken to be 85 per cent of the kilovolt amperes indicated, unless such low power factor is due to causes beyond customer's control.

Minimum Monthly Bill—The customer agrees to pay each month for firm power, including demand and energy, an amount not less than:

$0.81 times three-quarters of the highest measured monthly firm demand occurring during any month, during the previous twelve (12) month period, or the contract firm demand, whichever is the greater; and

Customer further agrees to pay each month for secondary power, including demand and energy, an amount not less than:

$0.30 times three-quarters of the highest measured monthly secondary demand occurring during any month, during the previous twelve (12) month period, or the contract secondary demand, whichever is the greater, except that in the event secondary power is not available, there will be no minimum bill for secondary service. If secondary power is available for only a fraction of a month, the minimum bill for secondary service shall be prorated. Customer shall not be obligated to pay a minimum bill for secondary power for more than 300 days in each year.

Table VI—Annual Cost of Supervision and Labor for Proposed Acid and Fertilizer Plant

Office and Laboratory

1 Superintendent	$ 4,000
1 Stenographer	1,500
2 Clerks @ $1,200	2,400
1 Chief accountant	2,400
3 Assistant accountants @ $1,800	5,400
1 Timekeeper	1,260
1 Chief chemist	3,000
4 Assistant chemists @ $1,800	7,200
	$27,160

Repairs and Maintenance

1 Master mechanic	$ 3,000
1 Electrical maintenance foreman	2,000
1 Shop foreman	2,000
1 Mechanical maintenance foreman	2,000
4 Millwrights on shift work @ 85¢	7,072
4 Millwright helpers on shift work @ 50¢	4,160
4 Electricians on shift work @ 85¢	7,072
4 Electrician helpers on shift work @ 50¢	4,160
2 Mechanics @ 85¢	3,536
2 Mechanic helpers @ 50¢	2,080
1 Lead burner @ 85¢	1,768
1 Lead burner helper @ 50¢	1,040
3 Pipe fitters @ 85¢	5,304
3 Pipe fitter helpers @ 50¢	3,120
1 Rigger @ 85¢	1,768
2 Electricians @ 85¢	3,536
2 Electrician helpers @ 50¢	3,120
2 Machinists @ 85¢	3,536
2 Machinist helpers @ 50¢	2,080
1 Sheet metal worker @ 85¢	1,768
1 Blacksmith @ 85¢	1,768
1 Blacksmith helper @ 50¢	1,040
1 Carpenter @ 85¢	1,768
1 Carpenter helper @ 50¢	1,040
1 Painter @ 85¢	1,768
1 Brickmason @ 85¢	1,768
2 Welders @ 85¢	3,536
8 Laborers @ 40¢	6,656
	$83,464

Raw Materials (Day Work)

1 Supervisor	$ 2,400
1 Yard foreman @ 75¢	1,560
1 Fireman @ 62½¢	1,300
4 Conveyor operators @ 50¢	4,160
2 Relief operators @ 50¢	2,080
2 Mill operators @ 62½¢	2,600
1 Truck driver @ 50¢	1,040
12 Laborers @ 40¢	9,984
	$25,124

Furnaces and Phosphoric Acid Plant (Shift Work)

1 Supervisor	$ 2,400
4 Foremen @ 75¢	6,240
12 Furnace operators @ 62½¢	15,600
4 Cranemen @ 75¢	6,240
8 Acid plant operators @ 62½¢	10,400
8 Acid plant operators @ 50¢	8,320
4 Weighmen @ 62½¢	5,200
4 Conveyor operators @ 50¢	4,160
2 Relief operators @ 62½¢	2,600
8 Slag tappers @ 50¢	8,320
1 Slagman @ 62½¢	1,300
4 Laborers @ 50¢	4,160
30 Laborers @ 40¢	24,960
	$99,900

Superphosphate Production

1 Supervisor	$ 2,400
3 Mixer operators @ 62½¢	3,900
1 Conveyor operator @ 50¢	1,040
6 Laborers @ 40¢	4,992
	$12,332
Total annual cost	$247,980

Taxes—The plant will necessarily be outside of city limits. A county and state tax of 3½ per cent on a 50 per cent valuation amounts to $45,546 per year on the plant.

Miscellaneous General Expenses—It is recognized that a small fund is necessary to take care of miscellaneous items incident to manufacturing. No basis for estimating the requirement is available. It has therefore been taken at 10 cents per ton of available P_2O_5 produced.

Credits to Manufacturing Costs

Slag—At the T.V.A. Fertilizer Works, the slag is crushed and screened in a small plant built for the purpose. The prepared material has all been turned over to other divisions of T.V.A. for road construction, concrete aggregate, etc., with a bookkeeping credit to the Fertilizer Works which somewhat more than covers the cost of preparing the slag. The open market for slag is, however, an uncertain one, and for the present purposes it will be assumed only that the granulated slag can be given away at the "Hydro Ash Tank" in the plant.

Ferrophosphorus—Practically all the iron carried in the furnace charge will be reduced, and will be tapped from the furnaces along with the slag in the form of ferrophosphorus carrying about 25 per cent phosphorus. The theoretical production in the plant under consideration will be somewhat more than 0.038 tons per ton of superphosphate produced. The actual recovery of salable ferrophosphorus from the slag depends upon how much equipment and care are used in separating it from the slag. For present purposes a recovery of 80 per cent theoretical is assumed, i.e., 0.03 tons per ton of superphosphate.

The market price of ferrophosphorus varies considerably. The current market price is $58 per gross ton for the 25 per cent phosphorus grade. It will be assumed that the ferrophosphorus can be sold at $50 per net ton. This gives a credit of $1.50 per ton of superphosphate produced, or $2.97 per ton of available P_2O_5 produced.

Other Credits—Although in the present cost study no credits have been taken except for the very certain one of ferrophosphorus, it may be worth while to point out others on some or all of which a commercial plant of the kind under consideration would certainly realize profits.

Elemental Phosphorus—By diverting a part of the gas stream from the furnace through very simple cleaning and condensing apparatus, elemental phosphorus may be obtained and sold at a higher price than the phosphorus finally brings in the form of superphosphate. The market for elemental phosphorus as such is not large but is profitable.

Purified Phosphoric Acid—There is a fairly large market for phosphoric acid purified to various degrees, the highest being that for use in food products. A manufacturer producing phosphoric acid for fertilizer use, having a large plant, would certainly be in position to secure a share of this market.

Slag Wool—It has been demonstrated at the T.V.A. Fertilizer Works that the slag as tapped from the furnace may be blown into slag wool with the greatest of ease. Inasmuch as the slag is of little or no value otherwise, and the cost of melting must be incurred anyhow, it should be very profitable to make and sell slag wool. There is an expanding market for this material, particularly where a fire-proof, vermin-proof, water-proof insulation is required, such as in house insulation.

Fluorine Compounds—Nearly all phosphate rock carries 3 to 4 per cent of fluorine. About 25 per cent of this fluorine is liberated in the furnace, probably as SiF_4, and passes out with the furnace gas. It should be possible to devise economically feasible methods of recovering this byproduct.

Related Manufacturing—With phosphorus, ortho-phosphoric acid, metaphosphoric acid, and phosphorus pentoxide available, it is easy to imagine that a commercial producer could enter one or more fields of chemical manufacturing to advantage.

Table VII—Summary of Production Costs for Concentrated Superphosphate

Item	Annual Cost	Cost per Ton Superphosphate	Cost per Ton Total P_2O_5	Cost per Ton Available P_2O_5	Per Cent Total
Lump rock or sinter	$550,966	$7.06	$13.81	$14.00	27.5
Phosphate dust	193,518	2.48	4.85	4.92	9.7
Silica pebble	29,792	0.38	0.75	0.76	1.5
Coke	74,806	0.94	1.88	1.90	3.7
Coal	1,915	0.02	0.05	0.05	0.1
Power	415,724	5.33	10.42	10.56	20.8
Electrodes	154,522	1.98	3.87	3.92	7.7
Water	15,614	0.20	0.39	0.39	0.8
Maintenance materials	70,264	0.90	1.78	1.79	3.5
Labor (all)	247,980	3.18	6.22	6.30	12.4
Medical	4,960	0.06	0.13	0.13	0.2
Storeroom	6,246	0.08	0.16	0.16	0.3
Depreciation	181,682	2.32	4.54	4.62	9.1
Taxes	45,546	0.58	1.14	1.15	2.3
Insurance	4,960	0.06	0.13	0.13	0.2
Miscellaneous	3,904	0.05	0.10	0.10	0.2
Total	$2,002,399	$25.62	$50.22	$50.88	100.0
Credit for ferrophosphorus		1.50	2.93	2.97	
Net cost		$24.12	$47.29	$47.91	

Total Production Cost

A tabulation summarizing all the elements entering into the cost of producing concentrated superphosphate appears in Table VII. It will be noted that in the total cost per ton of available P_2O_5, i.e., $50.88, the raw material costs are known accurately. The power consumption on the furnaces is known accurately, and the power rate is one which is open to contract to anyone and therefore involves no uncertainty. The cost of electrodes is known accurately. These items amount to 71.0 per cent of the total cost.

The cost of the plant is an estimate, based largely on actual construction costs in the T.V.A. Fertilizer Works and partly on carefully prepared engineering estimates. It cannot be far wrong and is probably higher than the actual cost would be.

The labor cost is based on two year's experience in operation of the T.V.A. Fertilizer Works, and represents the concensus of opinion of the Plant Superintendent and his several foremen. Water, coal, taxes, and insurance are relatively small items and it would require a gross error in the estimate to affect the final conclusion as to cost of available P_2O_5. The item of materials for repairs and maintenance is based on too short a period of experience to be considered highly accurate. However, this might be in error by 50 per cent without any large influence on the cost of available P_2O_5.

Depreciation cost may, at first glance, appear to be low. It will be noted, however, that about one-third of the total cost of the plant is in buildings of concrete, steel, brick, and a very high grade of protected metal, i.e., buildings of very low rate of depreciation. Also, it must be taken into account that where such things as furnace linings and parts exposed to severe acid corrosion are concerned, depreciation becomes nil by reason of frequent replacement, i.e., these costs are thrown into repairs and maintenance.

Other Considerations

It will be noted that the raw phosphate (lump for the furnaces and dust for the mixers) constitutes the largest single item of cost in the manufacture of superphosphate. The plant was assumed to be located near Wilson Dam, which requires that all phosphate be shipped in, carrying a freight charge of $1.47 per net ton. By locating a plant in Maury County, Tenn., adjacent to a phosphate washer, the freight could be eliminated. Allowing a switching charge of 10 cents per ton on the phosphate, the saving would be $1.37 per ton of phosphate or $4.70 per ton of available P_2O_5 in the superphosphate.

Likewise, a plant located in the phosphate fields would use for the furnaces a lump phosphate or sinter carrying sufficient silica so that no additional pebble would be required in the furnace charge, thus saving $0.76 per ton of available P_2O_5 in the superphosphate, as well as gaining an advantage in smelting because the silica would be intimately mixed with the phosphate.

Although a plant in middle Tennessee would actually be further from a coke supply than one at Wilson Dam, the freight is actually less by 16 cents per ton, and this would save about 7 cents per ton of available P_2O_5 in the superphosphate. The change in the cost of coal is too small to take into account.

The total saving on the phosphate, silica and coke would be $5.53 per ton of available P_2O_5 in superphosphate. However, against this saving, power would cost more, since there would be an increase in cost of transmitted power and a demand charge on secondary power. Taking the T.V.A. schedule, which would apply to this case, it may be calculated that the power cost per ton of available P_2O_5 in the superphosphate would be $12.63 as against $10.56 for a plant at Wilson Dam, an increase of $2.07. The net saving for the items mentioned above would therefore be $3.46 per ton of available P_2O_5, reducing the net cost from $47.91 to $44.45.

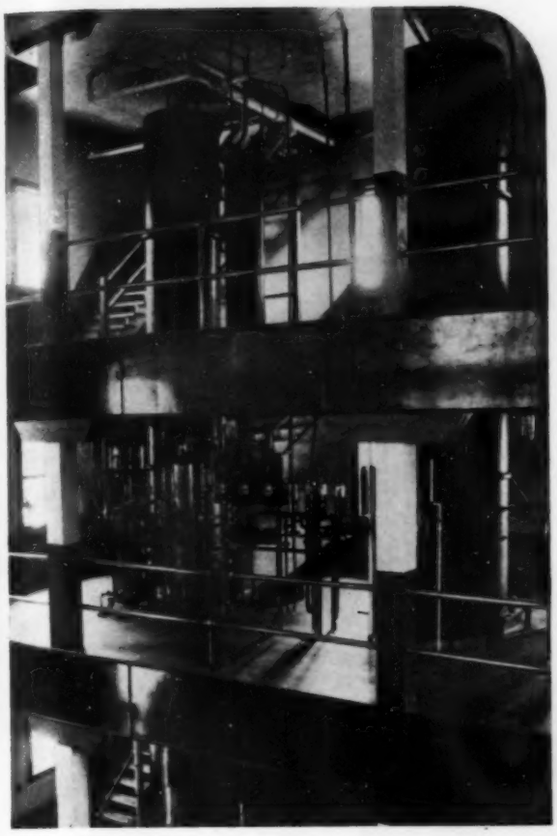
Conclusions

Competition With Low Grade Superphosphate—It was indicated at the beginning of this paper that a cost of $73.26 per ton of available P_2O_5 at a point of delivery where the freight item amounted to $4.50 per ton of superphosphate would permit a stock pile cost of $59.97 per ton of available P_2O_5 in the concentrated superphosphate (50.4 per cent P_2O_5) as compared with a corresponding cost of $38 per ton of available P_2O_5 for the lower grade superphosphate (19 per cent P_2O_5) in the stock pile. The cost of $47.91 per ton of available P_2O_5 indicated in the present study will permit delivery of the concentrated superphosphate at the same cost per unit of P_2O_5 in the lower grade superphosphate at a point where the freight is $0.73 per ton of material, i.e., very near the plant. The present study indicates, therefore, that the concentrated superphosphate can be manufactured and sold in competition with the lower grade superphosphates at points of low freight cost and can undersell the low grade superphosphate at points where freight cost is more than $0.73 per ton of material.

Investment Risks—The plant investment per ton of product is much less for the low grade superphosphate and the investment risk therefore less. An electric furnace plant for production of concentrated superphosphate must be a relative large and costly plant.

Relative Importance of Cost Items—It will be noted that cost of phosphate is 37.2 per cent of the total cost and power 20.8 per cent. Obviously plant location will be dictated to a large degree by these two items, and, inasmuch as power used per ton of phosphate may be transmitted at very low cost compared with the cost of transporting the phosphate, a plant location near the phosphate deposits is indicated.

Selling Price—Only the cost of concentrated superphosphate in the stock pile is estimated in this article. Some of the other costs, such as bags, freight, etc., have been mentioned. The selling price would, of course, have to include not only the direct costs here considered, but also such items as interest on working capital, selling costs, profits, taxes other than on the plant, etc. The present article is not concerned with price but with cost. It is to be noted, however, that a check-up on the retail prices of ordinary superphosphate in the neighborhood of Wilson Dam, Ala., in November, 1935, revealed prices ranging from $108 to $122 per ton of available P_2O_5, indicating that one might add to the stock pile cost of $47.91 a considerable number of other cost items and still sell at a profit.



Working deck, two-column brandy still, 120-130 gal. per hr. of 95 per cent

Wine Making Is an Art

By E. HUMBOLDT
Burbank, Calif.

"WINE is not a competitive price commodity; it is a competitive quality commodity!" This slogan is printed on the letterheads of the St. Helena's Lombarda Wine Co.

Wine making is an art. Wines of quality are made; they do not just happen. The wintner selects his grapes as to kind and quality, crushes and ferments them with the utmost care and cleanliness; and he selects his wines as to types. Then if he knows the ways of nature and is willing to work with her, helping along with a little care and plenty of common sense, time and nature will do the rest.

We know, of course, that the bulk of the market will always be for ordinary wines and that the industry is depending on these products for its existence. But, the reputation of American wintners will always come from recognition of fine wines properly selected and naturally matured.

Before the advent of Prohibition the California wine industry had achieved a reputation which gave it access to the world's markets; Prohibition, of course, killed it!

The only outlets Prohibition left for the manufacturers were: for sweet wines, the cordial, tonic, and bootleg industries; for dry wines, the sacramental market which used only a good grade of ordinary wine. A few wineries made grape concentrates for home brew consumption, but most of them closed down completely and allowed their equipment to deteriorate.

Repeal gave this dying industry a new lease on life; but it also brought along a new set of conditions and problems which had to be met and solved. The market for quality wines was almost non-existent while an enormous demand sprang up for sweet wines of medium quality and price. We all know that it takes time to resurrect a dead market; the industry had to depend on the existing market and, since the matured stocks were a mere drop in the bucket, it had to sell new wines.

New wines are harsh and unpleasant; moreover they are not stable. The trade wanted wines that were reasonably pleasant and that, when bottled, would remain clear until sold. The only thing to do was to try to imitate nature, but at a faster tempo—to condense in a few months the work of years.

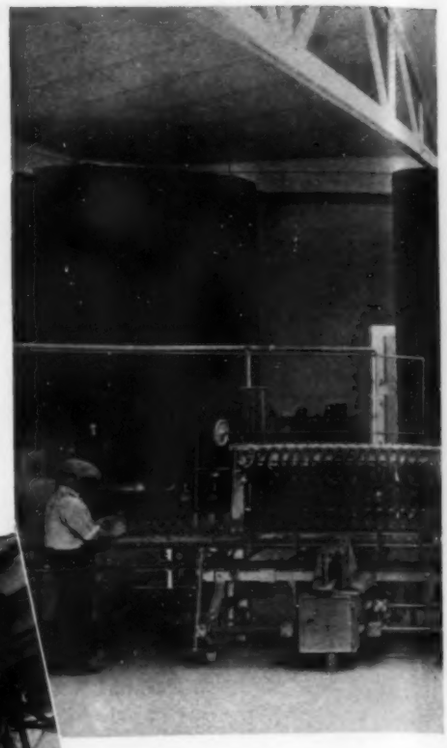
An SOS was sent out to the experts and the scientists who responded nobly with a lot of advice; and almost everyone started experimenting—with more or less success. There were, however, a few basic facts to be used as a starting point: the coagulation of some albuminoids by heat, particularly in presence of tannin; the acceleration of esterification by heating; the decrease in solubility of impurities at lower temperatures. Some wines that appeared to be satisfactory developed a persistent cloudiness, particularly after handling; investigation showed the cause to be the presence of ferrous ions picked from the equipment; during natural maturing this iron is oxidized and eliminated, in time. But, attempts to accelerate the reaction were not successful because of the introduction of undesirable secondary reactions; and other modes of treatment had to be used.

With fairly low iron contents, the addition of citric acid is sufficient; otherwise, a precipitation as ferrocyanide is the best solution, using the K salt as precipitant. Since the reaction slows down toward the end, it is advisable to use an excess of reagent, ultimately getting rid of it with gelatine, casein, or zinc sulphate; the last gives a fast and clean separation. The precipitate must be eliminated as soon as possible, and the work calls, of course, for strict chemical control.

Another evil was introduced by the march of progress: large wineries have to buy enormous amounts of outside grapes which are trucked in bulk. During a haul of 10 to 150 miles a good deal of bruising takes place and there is a strong tendency to local bacterial infection. The action is stopped by fermentation; but the bacteria remain, ready for action, regardless of the alcohol present, unless they are destroyed by pasteurization; close watching is necessary to keep within bounds that unwelcome bacterial action. A small excess of volatile acidity can easily be corrected by the addition of magnesia or neutral potassium tartrate.

Thus, the following "modus operandi" was evolved as a rough guide to be used according to conditions: The must is fermented down to the desired sugar contents, controlled by cooling or by the addition of sulphur dioxide, when it is stopped completely—preferably by pasteurization. It is then fortified by the addition of strong grape brandy (95 per cent) up to the desired amount mostly from 20 to 21 per cent, and allowed to settle for a week or two. As irrigated grapes are always deficient in tannin it is customary to add from 1 to 2 lb. per 1,000 gal. Tannin acts as a stabilizer.

After a proper decantation—racking—, the acidity is corrected and the iron is eliminated if necessary. Then, the wine is allowed to settle once more; precipitation of iron at ordinary temperature requires about two weeks. Prior to the ulterior treatments, the wine must be fined (clarified) or filtered absolutely clean and clear; this clarity is of the utmost importance because any suspended solids may, and generally will, affect the flavor of the finished product.



Right — Automatic bottling plant of the Burbank Winery, Burbank, Calif. Below — Concrete fermenting tanks, capacity 600,000 gal.

The must is fermented to desired sugar content when it is stopped completely — preferably by pasteurization

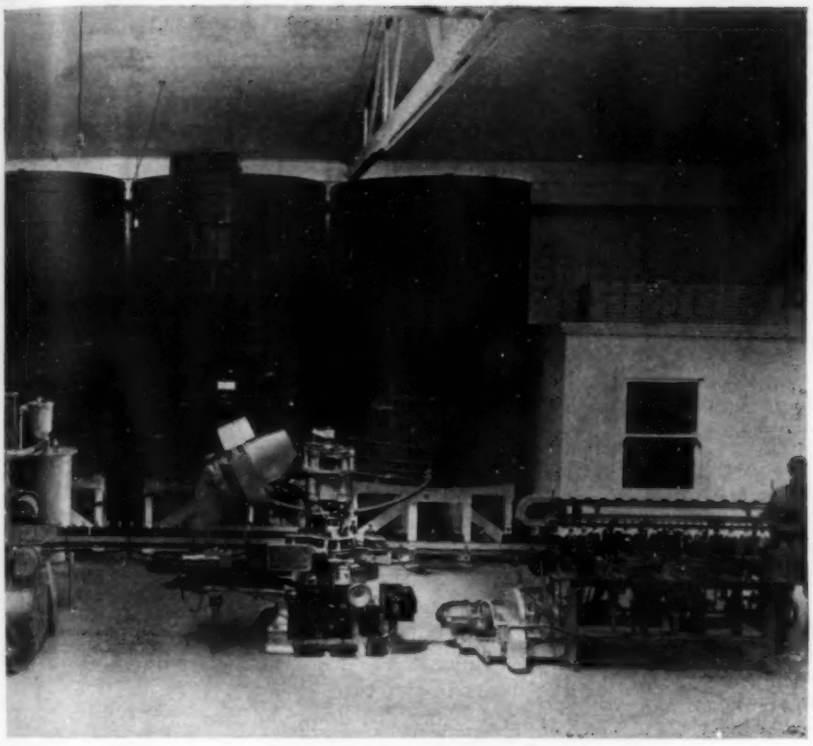
Sherry, of course, requires heating for two or three months at temperatures varying from 130 to 150 deg. F., and the warning about cleanliness also applies here. The other varieties can be matured immediately. The first step consists of pasteurizing at 140 to 160 deg. F. for a short time and quick cooling to room temperature. Coagulation of albuminoids and esterification are promoted, but quick cooling in the absence of air is necessary if the bouquet,—such as there is—, is to be preserved in its entirety. This is particularly true in the case of a highly flavored wine such as muscatel.

The next step can take place immediately although it is preferable to blend the various batches of each kind, for the sake of uniformity, since their ulterior behavior might not be the same in all cases. The wine is then cooled down to 22 to 25 deg. F. and kept at that temperature from two to four weeks; some people cool the wine to 18 to 20 deg. F. but such extremes are seldom necessary.

The solubility of most of the impurities is greatly decreased and an abundant precipitation takes place. At the same time, the low temperature favors production and elimination of compounds which were not pre-existent. The technique of cooling varies, of course, with the appliances at hand; large wooden tanks with at least three-inch staves are satisfactory, although concrete is worth trying. The properly cooled wine is generally allowed to warm up to about 32 to 34 deg. F. before filtering, and it should not be allowed to pass 35 deg. F. for fear that some tartar might be redissolved. The time spent in warming allows the sediment to coalesce and become granular instead of being fine and "mushy."

This filtration must be as nearly perfect as possible; the filtrate being stored in tanks that are clean and sweet and practically free from tartar. If the work has been well done, the wine should be stable and sufficiently matured for the existing market; although the longer it is kept, the better it will be. To insure a sparkling clearness the wine is generally given a "polishing" filtration immediately before bottling, in small filters of the Seitz type.

All of these operations sound easy, but, bear in mind that formerly few wineries, if any at all, were equipped for this kind of work. A good many of them had in-



creased their capacity for crushing, or for storage, in some unilateral manner and with much crowding. Most of these plants, although in the open country, had been built with a view to compactness which would hardly be tolerated on expensive city property and one often wondered where to locate the needed additional equipment. Filters were woefully inadequate both as to capacity and efficiency. In one case an old center feed filter press had been erected in the doorway—because there was no room anywhere else—and the wine had to be conveyed to that filter with a small pump located some 200 ft. away!

Engineers and manufacturers of equipment went into a huddle and the game started. Little by little, bronze and brass replaced iron in crushing rolls, pumps and piping; pasteurizers of improved design, fitted with exchangers, replaced the old coils which had been used without coolers. New filtering devices of medium size and large capacity, using Monel metal cloths and a good filter aid came into universal use; they can be cleaned "in situ" in a few minutes instead of the three or four hours necessary for the older types. Most of them are portable and fitted with their own pumps; and practically everything has been electrified.

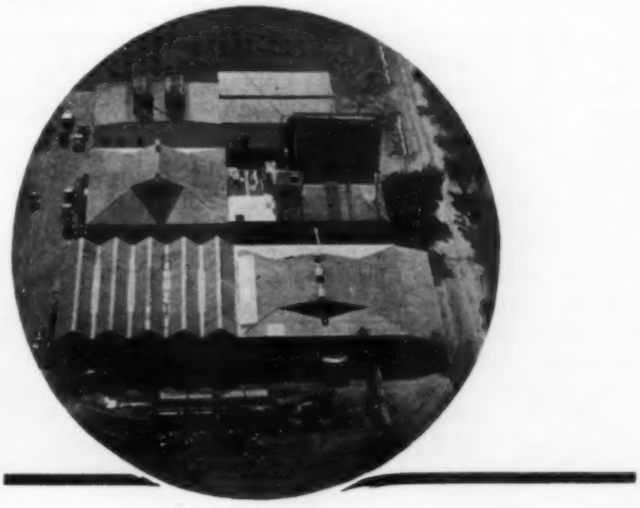
Most of the old plants that had refrigeration were using ammonia circulating in iron pipe coils that were copper plated on the outside, where the wine trickled down: the efficiency was low; the tartar deposit had to be brushed out from time to time and the copper soon wore out, with the result that as much iron was picked up during cooling as had been eliminated earlier. Practically all of those antiques have been replaced by well designed units made of stainless steel and generally constructed in several sections which can be cut in in series or parallel, according to conditions. Some other refrigerating mediums have also come into use; one manufacturer has built a number of self-contained units of large size, water cooled, which have given satisfaction.

The amount of fortifying brandy needed is quite large. It will average well over 5,000,000 gal. of 95 per cent for a 50,000,000 gal. wine production; and the old stills were not capable of meeting the demand. Some really high-grade stills were designed for that purpose, capable of segregating the fusel oil and the aldehydes, and yielding a product of high quality. Many wine men bought these stills and were rather proud of them. They soon discovered, however, that they could not dispose of the aldehydes without paying the tax. The joker who wrote the famous "Regulations No. 7" made no provision for their disposal; and so, the brandy manufacturers simply redistilled their aldehydes into fortifying brandy! It is expected that the U. S. Treasury Department will take some action about that disposal in the near future.

Since the value of any effort is measured by the results, one might ask whether any wine so processed is really good wine: It is!—according to the original stock used.

Of course, it cannot be expected that these products are equal to the high grade wines which have been naturally matured; but, the ordinary man can not tell the difference, and perhaps he would not care if he did. Quick-aged wines are clean and wholesome, fairly mellow, reasonably stable under ordinary conditions; and they meet an enormous demand for a fair product at a reasonable price.

Present conditions are somewhat better than they were last year, when some wines were marketed when less than six weeks old; the stocks on hand are ample to meet the demand until spring and there will be no necessity for marketing raw wines. And, we have every reason to expect that conditions will improve as the years pass by.



Steam Engines Contribute to Heat-Power Balance

By F. J. VONACHEN
Troy Engine & Machine Co., Troy, Pa.

In the past many articles have been published dealing with the attainment of balance between heat and power in process and other industrial plants, and the economies to be secured in this way. The fact that these articles have generally been written from the standpoint of turbine use is perhaps in part responsible for the feeling shared by many engineers that steam engines for this purpose are now obsolete. Yet, for a great many types of application this is by no means true, as will be evident to anyone who considers the advances made in this prime mover in recent years. Mr. Vonachen has prepared the accompanying informative article to bring us up to date on what is now possible with steam engines.—Editor.

IT IS A FACT known to every engineer that for best economy in process plants, all the steam generated should be made to do double duty; it should generate power and it should supply heat. When the required power can be skimmed from it and still leave steam just sufficient for process heating requirements, then perfect balance is attained. One efficient method of securing this desired condition is to pass the steam through a modern steam engine. About 90 per cent of the heat originally in the steam will be available in the exhaust for heating and processing, making the power developed a low cost byproduct.

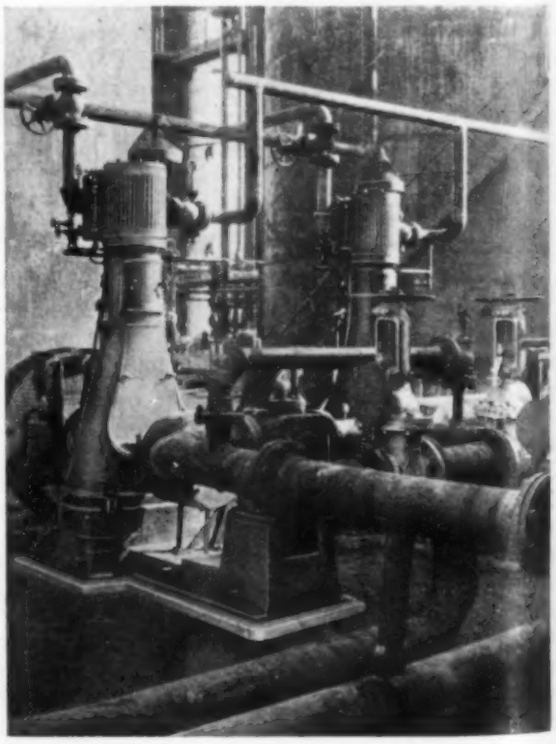
Since the low steam rate of the modern steam engine remains low throughout the entire speed range, even at the high back pressure which is sometimes necessary to obtain high temperature in the process, the quantity of exhaust best meets the requirements of the average plant and a good plant heat balance results. As this low water rate is closely maintained throughout the long life of the steam engine, the original plant heat balance is also maintained, an important factor in economy throughout the life of the equipment.

Certain processes require steam free from cylinder oil and it should be mentioned that many steam engines are being operated with complete satisfaction today, using saturated steam without oil for cylinder lubrication. A properly constructed cylinder, glazed by the use of beeswax and graphite, may be operated without any lubrication except possibly the introduction of a little beeswax and graphite at infrequent intervals. A solution of colloidal graphite in distilled water, introduced into the cylinder by a special mechanical cylinder lubricator, has also been used with success. The graphite concentration is so low that it does not interfere with processing or wash water, even when direct steam is used, and its effect on boiler operation is considered advantageous.

Steam conditions offer no particular problem, for modern steam engines are suitable for a wide range of conditions—from 20 to 400 lb. pressure, from very wet steam to 750 deg. F. total temperature, from vacuum to 75 lb. and higher back pressure. There is no limit to workable back pressure, provided sufficient initial steam pressure is available to produce the required power within the limits of practical cylinder bores.

Many plants today are doing without the benefits of heat-power balance, not realizing that the boilers they are now operating only for heating and process steam could be operated at a somewhat higher pressure and little additional cost, the steam passed through an engine before going to the process, and sufficient mechanical or electric power generated to take care of a part or all of their power requirements. The economy follows from the fundamental fact that in a boiler most of the

Steam engines driving transfer pumps in a refinery of the Standard Oil Co. of California



heat added is required to change the water into steam and only a small part of it to raise the pressure of the steam. Conversely, in skimming some 10 per cent of the heat and converting it into byproduct power with an engine, the great bulk of the sensible and latent heat, above the feedwater temperature, is still available for process use.

Economics of Engine Operation

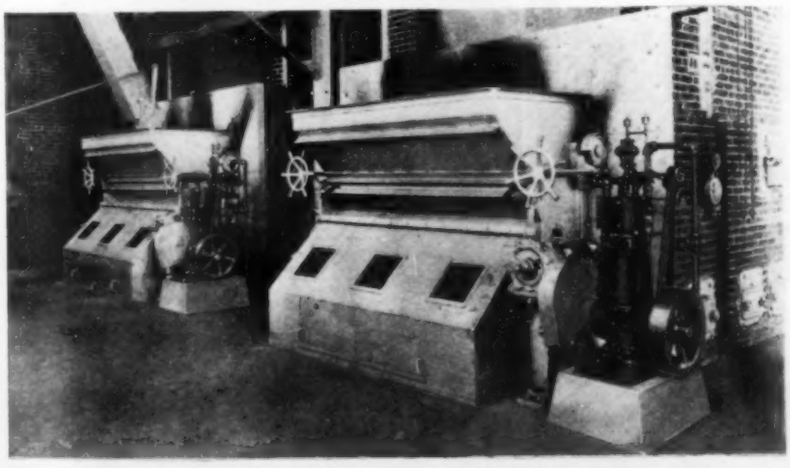
Cost of generating this byproduct power consists of operating and fixed costs. Operating costs include lubrication and about 10 per cent of the steam cost (the other 90 per cent being rightfully charged to heating cost). Fixed costs based on a 20-year life include interest on the investment, say 6 per cent; annual depreciation of 5 per cent; and annual maintenance of 2 per cent. As a general rule, no extra operating labor is necessary. In spite of numerous items in the cost, the total is so low that steam engines usually pay for themselves in 6 to 12 months by the saving in power cost.

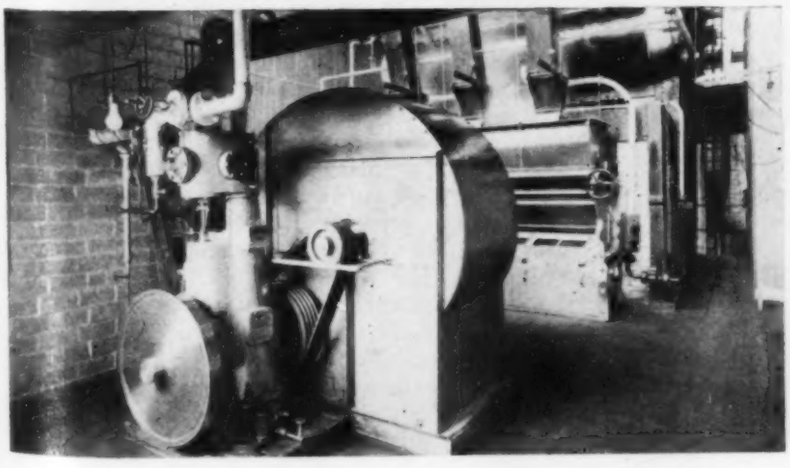
Although it is difficult to prepare byproduct power cost charts for the many conditions existing in process plants, it will be well to give a range of expected costs for both large and small engines for one particular set of average conditions. Assume the following: 150-lb. ga. steam pressure at the engine, no superheat; 5-lb. ga. back pressure; 2,000 hours operation per year with an average load 50 per cent of full load and all exhaust steam used; and steam costing 50 cents per 1,000 lb. Taking into consideration all operating and fixed charges, the cost of the byproduct power will range from 0.75 cents per brake horsepower-hour (1 cent per kilowatt-hour) in a small 12-hp. engine, to 0.3 cents per brake horsepower-hour (0.4 cents per kilowatt-hour) in a larger 225-hp. engine. These figures, it should be noted, are based on an average load which is 50 per cent of full load. With the higher average load existing in many plants, even lower costs are possible.

A good idea of the extremely low cost of modern steam engine byproduct power may also be had from the following actual plant surveys. The first will be given in considerable detail. It concerns a large industrial plant which generates steam primarily for heating and to drive air compressors. The only requirement for the exhaust steam is in the heating system. A 7x8 steam engine drives a draft fan and four underfeed stokers which operate the four 400-hp. boilers.

During the heating season (212 days) the plant heat balance is ideal as the heating load takes all the exhaust steam. In the summer months (153 non-heating days) there is an excess of exhaust steam. The officials of this plant state that they regard the steam engine drive as more reliable than other types of drive, that it provides simple automatic control of boiler operations and that its smooth automatic regulation over a wide range of speeds results in greater over-all boiler efficiency with consequent saving of fuel.

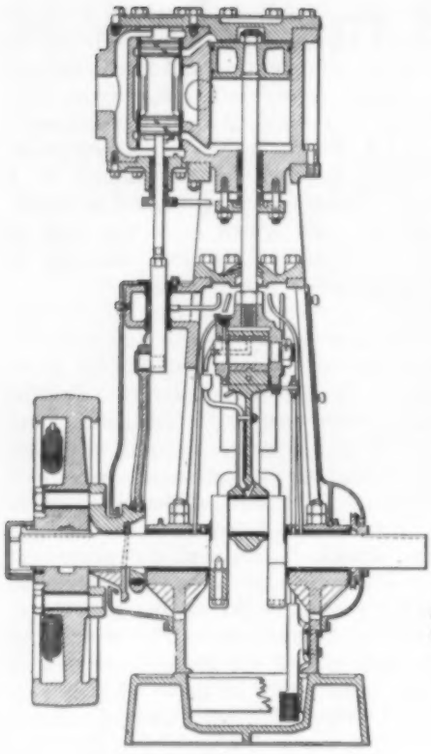
Two power plant applications of steam engines, the upper an installation for driving stokers, the lower an engine-powered draft fan



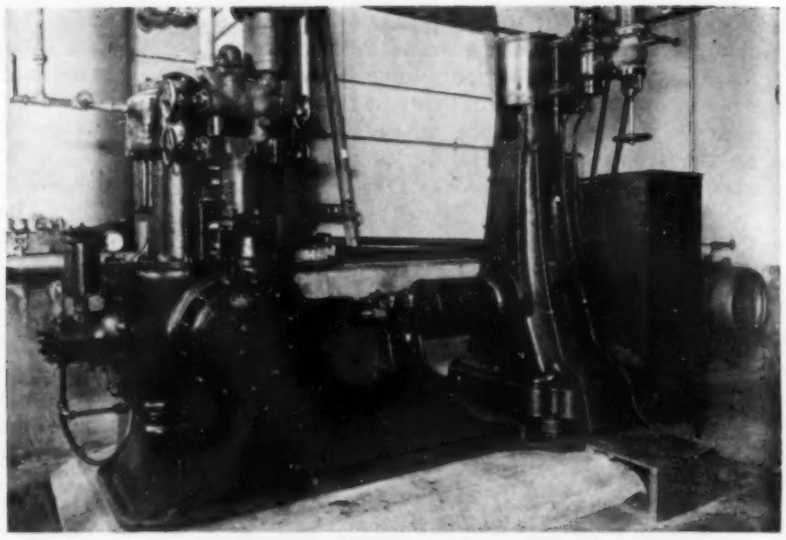


In this plant the boiler room operates 24 hours a day, 365 days a year, thereby imposing continuous duty on the engine, which runs normally at 300 r.p.m., producing as a maximum 42 hp., and on the average, 29.4 hp. The engine operates on 200-lb. ga. dry saturated steam, against a back pressure of 2.5 lb. First cost of the engine was $1,100 installed and the fixed charges, with depreciation at 5 per cent, average interest at 6 per cent and maintenance at 2 per cent, $111.65 per year. In the five years that the engine has been in continuous service, only one minor replacement (that of the governor gears) has been necessary.

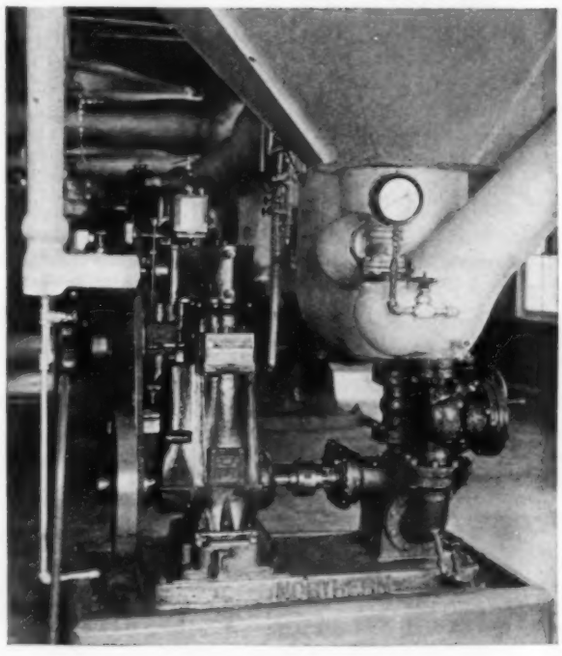
During the period of service the steam supplied to the engine has averaged 1,058 lb. per hour, which at 1,199 B.t.u. per pound, is 1,270,000 B.t.u. per hour. Heat consumed in work amounts to (29.4/0.873) 2,545 or 86,000 B.t.u. per hour, where 0.873 is the mechanical efficiency of the engine and 2,545 the heat equivalent of one i.hp. Heat loss due to radiation can be taken at 2 per cent or 25,400 B.t.u. per hour, making the heat used by the engine 86,000 + 25,400 = 111,400 B.t.u. per hour and leaving (1,270,000 — 111,400)/1,058 = 1,097 B.t.u. in each pound of exhaust steam. With feed water return at 185 deg. F., the available heat per pound of boiler steam is 1,199 — (185 — 32) = 1,046 B.t.u., and per pound of exhaust steam, 1,097 — (185 — 32) = 944 B.t.u. Hence the available heat in the exhaust is 90.1 per cent of that in the live steam. At a steam cost of $0.50 per 1,000 lb., for the 212-day heating season the cost of steam for power is 1,058 x 24 x 212 x 0.099 x 0.50 ÷ 1,000 = $266 and during the 153-day non-heating season, the cost is 1,058 x 24 x 153 x 0.50 ÷ 1,000 = $1,940. With lubrication cost $37 per year, fixed



Section of vertical engine



Above: Refrigeration compressor with steam engine drive in a large brewery



Right: Engines direct connected to circulating pumps in a Texas Co. refinery

charges $111.65, and no extra cost for labor, the total annual cost of owning and operating the engine comes to $266 + 1,940 + 37 + 111.65 = $2,354.65. This is equivalent to 2,354.65/(29.4 x 24 x 365) = 0.915 cent per brake horsepower-hour or 1.23 cents per kilowatt-hour.

Comparing the cost of 1.23 cents per kilowatt-hour as shown with that of operating an electric motor under similar conditions with purchased current available at 2 cents per kilowatt-hour, including the demand charges, there is a saving of $2,523 per year, 51.7 per cent of the first cost, which would pay for the engine installation in less than 6 months and show an annual return on the investment of 229 per cent.

This particular survey is a good example of a plant that has use for exhaust during only a part of the year. If the exhaust is used the entire year, as it can be in many plants, the cost is considerably lower.

Annual Saving 66 Per Cent

Another plant produces its own light and power at an annual saving of $764 or 66 per cent over purchased power. Three 150-hp. boilers supply steam. The 30-kw. direct-current generating set receives saturated steam at 115 lb. pressure, generates 68,000 kw.-hr. annually and returns the exhaust to steam heating coils in a kiln which serves to dry molded blocks preparatory to firing. The low maintained steam rate of this generating set is responsible for proper heat balance and low power cost.

The electrical energy generated supplies a 16-hour night-shift power load consisting of three to five 5-hp. kiln oil-burning motors, a 10-hp. air compressor motor, a 1-hp. electric hoist, and also the lighting system. The cost is slightly more than 0.5 cent per kilowatt-hour, compared with the local utility rate of 1.7 cents. The annual cost is $391.77 ($237.90 fixed charges and $153.87 operating cost) as against $1,156 if the power were purchased. The saving constitutes a yearly dividend of 29.4 per cent on the original investment.

This steam engine generating set has been in service for 5½ years, there has been no power failure, nor have any repairs or replacements been required in this time.

Thermal economy is not the only advantage derived from a setup such as one of those described. In addition, the accuracy of control obtainable, the ready speed variation and the reliability of the power producing equipment will pay constant dividends. That steam engines have definite advantages in these respects in process plants is evident from the numerous installations that have recently been made in such industries as: chemicals, ceramics, coke, drugs, explosives, fertilizer, gas, glass, glue, leather, oils, paints, paper, petroleum, rayon, rubber and soap, where engines have been used in driving such equipment as: stokers, forced and in-

duced draft fans, blowers, exhausters, ventilating fans, pumps, cookers, dryers, generators, presses, mixers, mills, air and refrigeration compressors, line shafting, conveyors and balers.

Modern steam engines have a wide, smooth, flexible, easily adjusted speed range with infinitely small steps, easily connected to and operated by automatic control. Whether the control is manual or automatic, definite speed is maintained for each point of control. In other words, there is good regulation and—of prime importance—no hunting. The engine is also quickly started, very little warming-up being required. It can be placed in service without delay.

Governors are of two types, throttling and automatic. The throttling type, of proper design and materials for the steam conditions, is used in adjustable speed service in three ways: (1) for manual control; (2) as a maximum speed stop in conjunction with automatic control; or (3) with an attachment directly connected to the automatic control, in which case the governor maintains definite engine speed for a particular setting of the control. With a throttling governor, the engine is furnished with: (1) a fixed eccentric having a fixed point of cut-off; (2) with a hand adjustable eccentric by which the cut-off can be varied when the engine is not running; or (3) with a variable eccentric by which the cut-off can be varied while the engine is running by simply turning a hand wheel. The last two devices permit setting the cut-off at the most economical point, thus decreasing the steam consumption approximately 10 per cent below that obtained with a fixed eccentric. They also permit reversing the direction of rotation. For wide speed range this type of governor can be furnished with a V-port valve cage which makes the governor stable at very low engine speeds or very light loads with the governor valve just cracked.

The automatic or flywheel type of governor automatically adjusts the cut-off for best economy but is suitable only for constant speed service, although it can also be used as a maximum speed stop in connection with automatic control in variable speed service. Its regulation is within 2 per cent from no load to full load.

Steam engine speed is conservative and conducive to long life. Compressors, fans, generators, rotary pumps and exhausters may be direct connected. Only small speed reduction is necessary to drive stokers, cold and hot oil charging pumps for refineries, cookers, mixers, presses, mills, balers and conveyors. Higher speed fans, blowers and dryers may be driven by flat or V-belts, or chains. The engine's high starting and running torque and large overload capacity are desirable features for most installations but particularly so for pumping viscous materials and for operating dryers, presses, mixers, conveyors and balers.

How Modern Engines Are Built

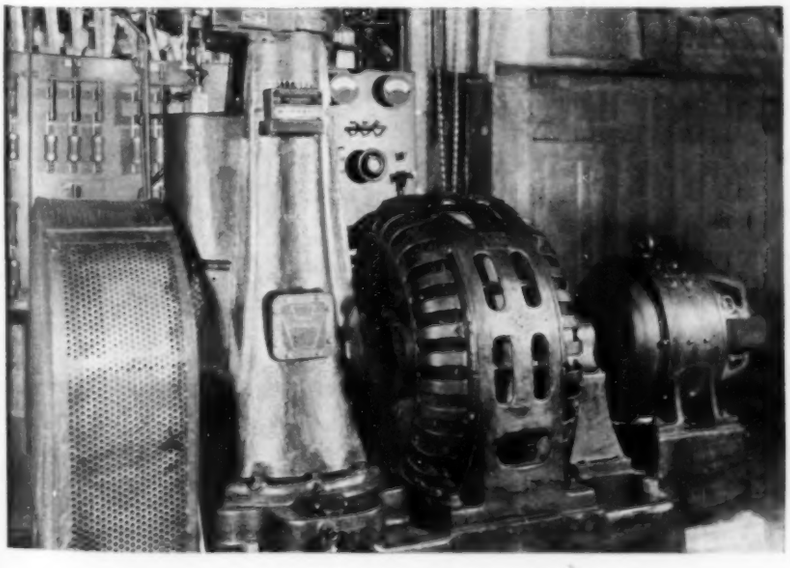
As to reliability, modern heavy-duty engines are of simple, rugged construction, as nearly foolproof as it is possible to make them. They have been continuously improved and are fully inclosed, self-oiling and oil-tight. Quite commonly they give months of continuous service at full load. An example is a recent record still run made at the Kendall Refining Co. where an engine drove a side-cut pump 24 hours a day for 168 days continuously.

In the equipment made by the writer's company, modern design has involved the use of alloy iron for all parts of the cylinder, steam chest, piston and valve in contact with the steam. A replaceable, ground valve chamber bushing with accurately milled ports is used for the piston type valve, making reboring of the chamber unnecessary. When a flat valve is used it is made very light in weight to reduce friction and wear and is ground to the seat under pressure. The former type is particularly suitable for dry or superheated steam and the latter for very wet steam, in order that it may automatically lift from its seat to relieve the cylinder of excessive condensate.

In this type of engine, bearings throughout are of bronze or babbitt, equipped with laminated shims or other simple adjustments to insure long life through a generous adjustment range. The lubrication system, designed for convenience, reliability and low oil consumption, makes use of an oil reservoir in the base, equipped with a separator and automatic water drain for condensate. The oil pump, located in the reservoir, delivers oil to a distributing box with adjustable, readily visible, sight feeds to all bearings. A new type of watershed partition used between the cylinder and the crank case in vertical engines, and one of the most important improvements made in this type of engine in recent years, drains any cylinder oil and condensate which pass the piston rod and valve stem stuffing boxes from the engine, while at the same time it prevents bearing lubricating oil from working up entering the cylinder.

Thus oil loss is avoided and steam contamination is prevented, a vital feature in engines operating without cylinder lubrication.

Alternating current generator powered with a vertical steam engine



Choosing Conversion Units for

By C. C. LEVY

Industrial Application Division
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

PRODUCTION by electrolytic methods, of chlorine, hydrogen, oxygen, aluminum, and many other commercial products, presents one of the very few demands for a large direct current power supply. Because of limitations in the capacity of units, and because of transmission losses, it has never been possible, except when the units can be located very close to the cells, to justify the generation of direct current for this purpose. As a result the conversion of a.c. to d.c. is a subject of extreme interest to engineers who operate electrochemical plants.

For many years the motor generator and the synchronous converter, were the only two conversion units available for this service. However, the increasing use of mercury arc rectifiers in electric railway substations, has naturally promoted the desire to try out the steel tank rectifier as another means of supplying the electrolytic cell loads. That this new unit has some real advantages, is shown by the fact that in the last two years practically all new conversion units installed have been mercury arc rectifiers.

The history of conversion units in this service shows three marked changes. Because of the necessity for voltage variation in operating electrolytic cells, the earliest applications were either motor generator sets, or synchronous converters of the booster type. The booster converter had the advantage in efficiency, although the addition of booster parts added complication. The next step was to eliminate the booster by using a straight shunt converter, obtaining the d.c. voltage range, by means of taps on the transformer, which could be adjusted under load by a suitable motor operated tap changer.

The third step has been to turn to the mercury arc rectifier in order to obtain certain additional advantages. These are, first the advantage of static equipment, and secondly avoiding the disadvantages of the commutator and the a.c. collector rings of the synchronous converter. These two have always been the principal drawbacks to the use of rotating conversion equipment, because of the extra maintenance required where large currents and maximum continuous load operation prevails. A third advantage of the mercury arc rectifier is the ability to withstand the deleterious effects of the corrosive atmospheres of most chemical plants. In this it is quite superior to the rotating units, because corrosion seriously increases commutator maintenance and adversely affects performance.

The advantages mentioned above have not alone justified the decided trend to the mercury arc rectifier. Another factor, that of efficiency, enters into the picture and has influenced all recent applications. Because of the fact that the efficiency of the mercury arc rectifier increases materially as the operating voltage increases, the obvious expedient of increasing the number of cells in series in a cell block can be, and has been adopted so as to obtain the added advantage of more efficient operation. It is significant that all the recent installations of mercury arc rectifiers in this service operate at 500 volts and above instead of the more usual 250 or 125 volts.

In addition to these three types of conversion units, there has been recently developed a fourth type which is now available but only in much smaller units than the other conversion units. This is a mercury vapor rectifier known as the Ignitron rectifier, but differing from the conventional mercury arc rectifier in two important respects: In form, the Ignitron consists of a single anode, with its corresponding mercury pool cathode mounted in a small individual water cooled steel tank; in operation, the arc is started in each individual tank once each cycle during the positive half of the voltage wave by means of an igniter, when the potential of that anode rises to a predetermined value above the potential of the cathode, and dies out each cycle as the a.c. voltage impressed on that anode decreases and the anode ceases to carry current.

While the efficiency of this type of rectifier is high, practically on a par with the synchronous converter at 250 volts, its capacity at present is so small that its use in electrochemical applications is justified only in a few special instances.

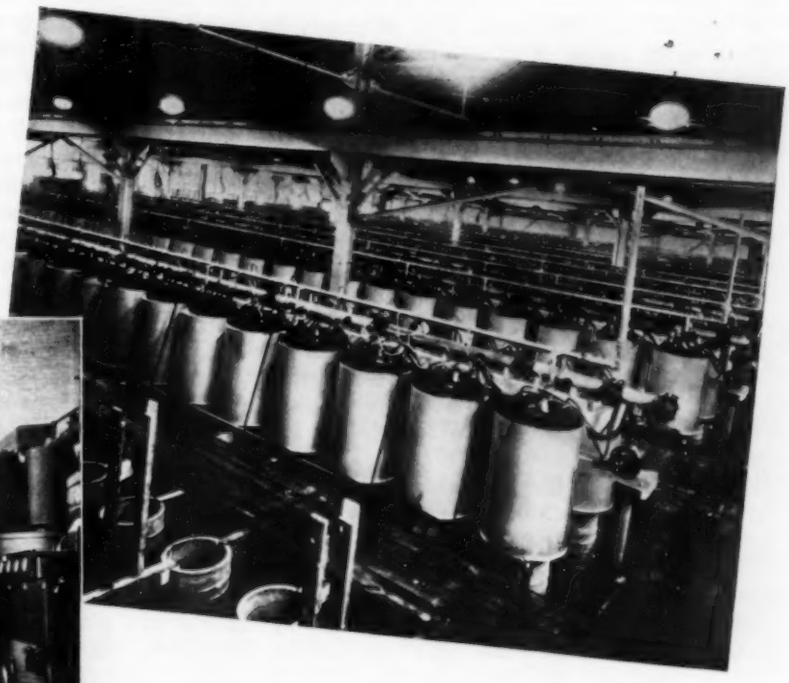
To compare these conversion units for electrochemical service in greater detail, their individual characteristics will be considered from several viewpoints.

Overall Efficiency: Efficiency is generally a matter of great importance, particularly when purchased power is used. In order to make the comparison more specific a capacity of 1,500 kw. has been chosen for the conversion unit, and full-load efficiencies tabulated for that capacity are sufficiently accurate for comparative purposes. The figure includes the transformer losses for both the converter and the mercury arc rectifier, and also includes the auxiliary losses such as rotary vacuum pump, etc.

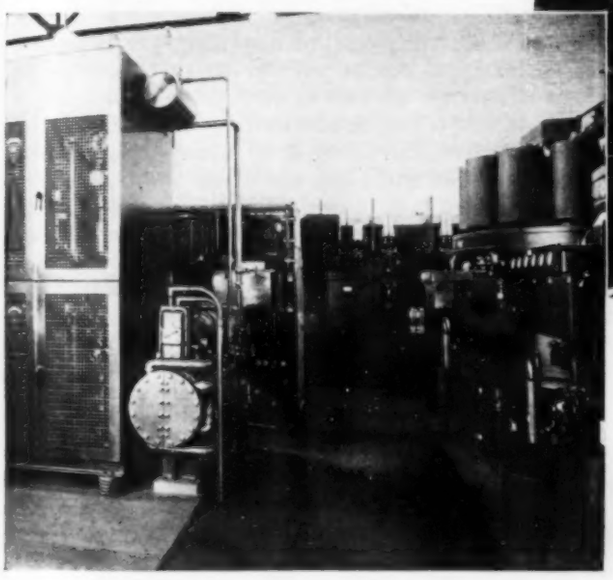
Volts	*Shunt Converter*	*M.G. Set*	*Rectifier*
250	92.3	89.9	90
600	93.5	90.3	94.3

Full load efficiencies only are given since most electrochemical loads operate at this value continuously. In some cases reduced load is obtained by reducing the voltage and holding the current constant. In such cases the actual partial load efficiencies differ to some extent

Electrochemical Plants



Right—Modern electrolytic cell room. Below—3000 kw. sectional mercury arc rectifier supplying 6000 amp. for electrolytic load. Note compact heat exchanger



from conventional partial load efficiencies. This is because full load copper losses must be combined with reduced core losses in the case of rotating equipment, while in the case of the rectifier constant arc drop due to constant full load current must be combined with full load copper losses and reduced iron losses of the transformer.

Space Required: Installation space for the motor generator set even though no transformer is required usually exceeds that required for the synchronous converter or the mercury arc rectifier.

Installation Cost: Installation costs for rectifier are ordinarily considerably less than for rotating equipment for the following reasons: (1) No special foundations required, (2) Building costs less due to saving in space, (3) No special arrangements for ventilation required since the rectifier is a water cooled device. This last consideration is more important than is generally realized. When substations are crowded with rotating equipment forced ventilation of the room or enclosed force ventilated units must be employed to remove the losses from the substation and permit operating the units at maximum load and efficiency.

Maintenance: The absence of high speed moving parts such as a commutator and collector will make the maintenance charges for a rectifier less than those for the motor generator set or synchronous converter. Replacement expenses will similarly be less for the rectifier on account of the absence of brushes. Maintenance cost of the rectifier should be less than either the motor generator set or the converter.

Operating Characteristics: A clear picture of the differences in operating characteristics of these various conversion units is desirable. The motor generator set is the only one in which the d.c. end is not affected by voltage variations in the a.c. end of the conversion system. In some applications this independence of the d.c. end is a distinct advantage of the motor generator unit. Both the synchronous converter and the mercury arc rectifier deliver d.c. voltages which have a fixed ratio to the a.c. voltages, and therefore will vary with fluctuations in the a.c. line voltage. The synchronous converter is more susceptible, to load fluctuations than either the motor generator set or the mercury arc rectifier, but in this type of service fluctuating load conditions are unusual so that this is no drawback to the use of the converter.

The three conversion units differ as far as their operating characteristics are concerned, chiefly in the manner of obtaining variation of the d.c. voltage. This is one necessary requirement of conversion units in this service and will be discussed in separate heading below.

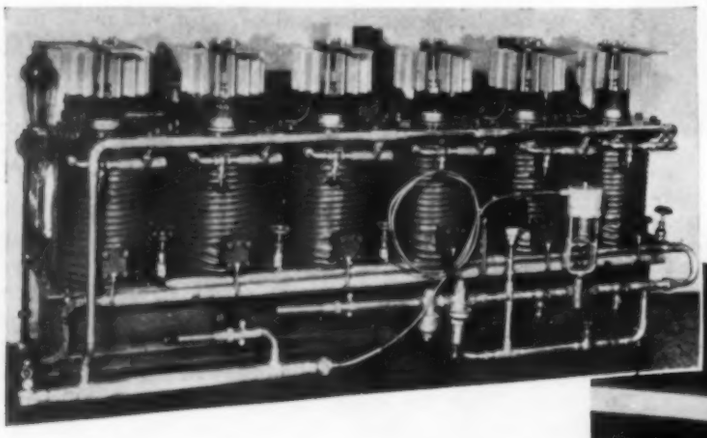
D.C. Voltage Regulation: Most electrolytic plants work on a constant current variable voltage basis, and require under normal operating conditions only about 10 per cent change in the d.c. voltage. This range is

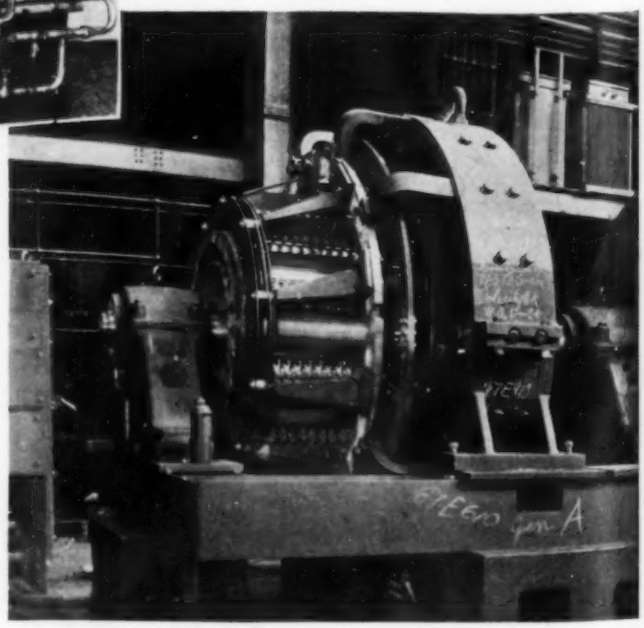
usually sufficient to take care of change in resistance of the cell, removal of the cells for maintenance purposes, etc. Many applications however require lower d.c. voltages for starting up the cells, and in some cases it is necessary to operate at reduced loads for considerable periods of time, particularly when production must be limited. In such cases it is necessary to provide a much wider range, or at any rate to provide for operating continuously at lower d.c. voltages. The various conversion units can be arranged to meet this requirement of voltage range, though in somewhat different manner. The mercury arc rectifier by means of grid control can readily take care of the relatively small range required for normal full load operating conditions. The required wider range for seasonal variations in production is better taken care of by putting taps on the transformer rather than by extending the range of the grid control. This is principally because the power factor due to the increase in distortion factor of the wave becomes considerably worse with the rectifier operating by grid control at low d.c. output voltages. In addition continuous operation of grid control at an appreciable reduction in the d.c. voltage causes an increase in the harmonics due to the distortion of wave form and has a possible adverse effect on heating of the generating units supplying the load.

D.c. voltage regulation is simply obtained on the motor generator set either by control of the self excited shunt field or where wider range is required by control of a separately excited shunt field on the d.c. generator.

Voltage control of the converter is not as simple as in the two cases mentioned above. Where booster converters are used, approximately 10 per cent range on either side of the neutral point voltage is usually obtained by adjustment of the booster field. This, however, involves special rheostats and control, and the range is limited. For low voltages taps are provided on the transformer. In the case of shunt converters a combination of step regulation by load type tap changers, and field control of the converter between steps is employed. Here again it is sometimes necessary to provide additional taps on the transformer where a wide range of regulation is necessary. In some cases an induction regulator on the primary side of the converter transformer has been used, but this generally requires more space and is more expensive than the step regulation incorporated with the transformer.

Spare Capacity: The continuous maximum capacity characteristic of electrochemical loads, is a strong argument in favor of spare capacity in a plant. Maintenance should properly be considered as a preventative rather than a cure for troubles. From this standpoint spare capacity in an installation is necessary. When large units are employed as is generally the case in electrochemical plants, this question of reserve capacity becomes important because of its bearing on the initial cost of the equipment. In large plants where several units are operated in parallel on the bus, the loss of a single unit due to some unforeseen condition or accident may not be serious unless all the units are already operating at full load, and even then reserve capacity need only be just sufficient to carry on until production can be reduced. Where rectifiers are used they can of course be paralleled in a similar manner so that there is no essential difference as far as that goes. However, a distinct advantage can be obtained by a scheme of sectionalizing the rectifier, that is by using a combination of several smaller tanks supplied from one transformer of suitable design and rating. This sectional type rectifier makes it possible to take advantage of the inherent overload capacity of the mercury arc rectifier, so that specific spare capacity would not be necessary to replace a tank which must be taken out of service. In the case of other types of rectifiers where a single large





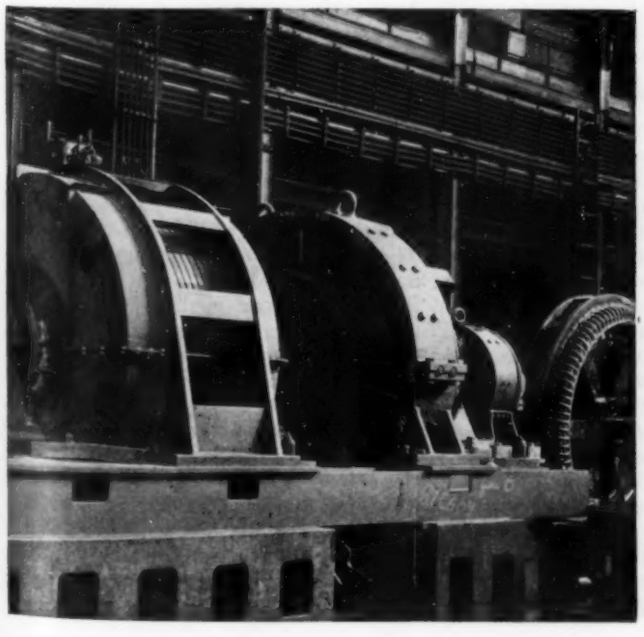
Left—Ignitron rectifier. Below—Typical three unit motor generator set

capacity tank is used, just as in the case of rotating conversion units, a complete additional unit is necessary to accomplish the same results.

Considering the sectional type of rectifier, that is an assembly of several small tanks supplied from a single transformer, we find that it lends itself also to a scheme of automatic sectionalizing, so that where an arc back occurs in one tank, that tank can be immediately switched out of the circuit leaving the others connected to the load, and since the tank in trouble is a small part of the total capacity the effect on the output voltage is purely transient.

First Cost: This important consideration is closely connected with operating voltage. For example, if it is definitely decided that operating voltage must not exceed 250 volts a price analysis will show that at this voltage the price level of the converter and the motor generator are about the same unless voltage range is required, in which case the price level of the converter is somewhat higher. However, the higher efficiency of the converter will easily take care of this differential. On the other hand the mercury arc rectifier at 250 volts is somewhat higher in price than either the converter or motor generator set, so that from an economic standpoint the additional investment is not justifiable when we consider that its efficiency at this voltage is on a par with that of the motor generator set or at any rate little better, and is definitely below that of the synchronous converter.

Summary: In some cases the type of conversion equipment which should be used can be settled without a detailed analysis, because one or the other of the application conditions will predominate. For example, if conditions are such that efficiency is the chief consideration then for 250 volts the synchronous converter would be preferred. For 500 or 600 volts, the mercury arc rectifier would more likely be selected. For voltages lower than 250 volts the motor generator set would generally be the preferred unit. However no hard and fast rule can be laid down in this matter, since the economical application must consider first cost, maintenance and operating expense as well as efficiency, and the operating engineer is going to put a good deal of importance on the reliability of the unit and to the ease and simplicity of the control which is often left to unskilled operators. Since it appears that when the mercury arc rectifier is applied the operating voltage must be at least 500 volts to take advantage of the efficiency characteristics of the rectifier, the question of operating voltages is one of great importance.



In general, commercial electrolytic plants are operated as series parallel systems, that is to say the individual cells which require comparatively low voltage are connected in series to form a cell string or unit, and these cell strings then operate in parallel from a set of d.c. busbars. The general practice in the past has been to operate these busbars at a nominal voltage of 125 or 250 volts. These voltages were convenient when a motor generator set or synchronous converter was used to supply the d.c. energy. When mercury arc rectifiers are used it is found that operating voltages of 500 or 600 volts are required to show an efficiency improvement. From purely general standpoint, we may say that the higher the operating voltage is the less the investment in copper so that we would expect this voltage to be pushed as high as practical. Here again however cell characteristics and operating conditions have a determining influence. Electrolytes are not easy to insulate, so that cells invariably have leakage paths to ground of varying resistance. It will generally be found in such circuits that a voltmeter connected to ground on one side and to various points on the cell string on the other will read zero at some point along the cell string. This point is the electrical neutral and generally it will not be at the middle of the cell string because of lack of uniformity in leakage circuits. Ground indicating lamps or ground alarm relays are often used in a circuit of this kind to detect the presence of an abnormal ground.

Operation at 500 or 600 volts in electrochemical plants is not entirely a new idea, introduced for the purpose of using a mercury arc rectifier to best advantage, because 600 volt cell circuits have been used for many years, particularly in aluminum, production of electrolytic zinc, and hydrogen oxygen cells. In fact previous to the use of mercury arc rectifiers at least one company producing chlorine has operated their cell room at 600 volts for many years and have never had any fatal accident or any trouble due to excessive leakage at 600 volts.

Recent installations of mercury arc rectifiers in this service indicate that operation at 500 volts or even higher voltage presents no great problems in cell room operation, and undoubtedly future electrochemical installations will be planned for operation at the higher voltages.

It is apparent from the foregoing analysis that operating engineers have available a sufficiently wide choice in conversion units for this service. Other types of rectifying and conversion units are in the development stage with a decided trend towards the use of static equipment rather than rotating equipment for this purpose. Future progress in the way of improvement of the existing conversion units and development of newer devices may be expected.

Reader's VIEWS AND COMMENTS

T.S.P. Not TSP

To the Editor of Chem. & Met.:

Sir:—We are all quite stirred up around here by the picture on page 584 of the November number of *Chem. & Met.* showing the trisodium phosphate storage building at Wilson Dam, Ala.—the size of which would indicate probably the largest TSP plant in the United States. None of us had ever heard of it. Is it true, as the picture suggests, that our government has gone into the TSP business in such a big way in the Tennessee Valley? We have read with interest the accompanying article by Dr. H. A. Curtis and associates, but find no mention whatever of TSP.

CHEMICAL MANUFACTURER

EDITOR'S NOTE:—Photograph WH-12912 taken October 6, 1936 by official T.V.A. photographer G. L. Bracey and supplied to us by Dr. Curtis, carries this caption: "View taken of the North Half of the T.S.P. Storage Building at the fertilizer works, Wilson Dam, Alabama, showing the manufacturing and ammonia storage buildings. View looking east." In Chem. & Met.'s vernacular T.S.P. meant only trisodium phosphate, but it should not have taken very much detective work on our part to have discovered that in T.V.A., T.S.P. might very well mean "Triple superphosphate". We are sorry so to have stirred up our readers.

"Old Man Corrosion"

To the Editor of Chem. & Met.:

Sir:—May we thank you for James A. Lee's thoughtful and entertaining review of our recent book, "Corrosion Resistance of Metals and Alloys," as published in *Chem. & Met.* in July. The writer has been gratified by the opinions of reviewers with wide differences of interest and experience who, in addition to many polite complimentary remarks, have expressed, better than we could have done, certain new departures in thought and method in the presentation of the rather difficult subject.

Mr. Lee, speaking from his own considerable acquaintance with the solution of corrosion problems, has given us food for thought in his fair-minded review. While sugar-coating his pill with the term "splendid work," he calls us to task for omitting silver and the noble metals from our data, and also certain new alloy combinations. Mr. Lee's point is well taken. Silver, and the rare and precious metals, offer many practical and interesting features in corrosion resistance. In defense, will you permit us to say that a considerable amount of work was put on the accumulation and presentation of data on these metals. Unfortunately, as this material approached its final form it was evident that in completeness and accuracy the data were far inferior to those available on the more common metals. It was part of our plan to use only reliable facts and to exclude all vague and general statements, as well as statements not based on actual test or experience. Therefore, there seemed to be no alternative but to omit that section.

The general plan of the work, which makes such an omission obvious, serves, we hope, a useful purpose if it brings to light a lack of quantitative information on such an important subject.

To be quite honest, now that the work is being so well accepted, there were other cases where we found it necessary to stand on a pair of jacks when at least three of a kind were indicated, rather than to pass, as we did in this case. We hope that good data may be made available in the near future, not only on silver and the noble metals, but also on the others where information was incomplete.

ROBERT J. MCKAY
ROBERT WORTHINGTON
The International Nickel Co., Inc.
New York, N. Y.

Materials of Construction File

To the Editor of Chem. & Met.:

Sir:—I believe it would be an excellent idea for you to start a loose-leaf data book on materials of construction, in which one can keep filing important data and information as it appears in your magazine from time to time. In this way, if one wishes to build up a loose-leaf data book on stainless steel, he can continue doing so with reprints and loose-leaf data that you would send out. The same would hold good on aluminum or any other alloy used in construction in present-day engineering.

The alloy field is growing to such proportions that it is almost impossible for one to keep any accurate engineering information outside of references. I believe this idea would be received favorably by any engineering group of men, and I believe that anyone would be glad to contribute to the nominal cost for keeping up such a service.

M. C. LUDWIG
Stainless Steel Metallurgist
Equitable Equipment Co.
New Orleans, La.

EDITOR'S NOTE:—In response to numerous requests, *Chem. & Met.* has made up some bound reprints of the editorial section of its October "Materials of Construction" Issue. These are available at a price of 50 cents each.

Unit Processes Up to Date

ELEMENTS OF CHEMICAL ENGINEERING. By *Walter L. Badger* and *Warren L. McCabe*. 2nd Edition. McGraw-Hill Book Company, Inc., New York City. 660 pages. Price $5.

Reviewed by *Albert B. Newman.*

THE OBJECTIVES and scope of the revision of this standard textbook can be best told by quoting from the preface to the second edition: "Enough time has elapsed since writing the first edition so that appreciable contributions to many of the subjects treated in this book have appeared in the literature. Our effort in the second edition has been to incorporate as much as possible of this new work without departing from our original idea of an elementary text. Some parts have been rewritten in an attempt to achieve greater clarity or simplicity in the presentation.

"The principal changes are in the chapters on Flow of Heat, Evaporation, Drying, Distillation, Gas Absorption, Extraction, and Filtration. Minor changes have been made in other chapters where this seemed desirable. In conformity with recent tendencies, dimensionally consistent units have been used in place of miscellaneous engineering units. The symbols used have been made to correspond, so far as possible, to the recommendations of the Committee on Standard Symbols and Nomenclature of the Amerıcan Institute of Chemical Engineers."

The line drawings were one of the outstanding features of the first edition, and these have been retained. Some of the topics have been expanded, resulting in the addition of 35 pages. The reader may be disappointed to find no use of the Merkel chart in evaporation problems or methods for calculation of multi-component systems in distillation problems, but the authors have wisely devoted the available space to the more elementary principles which can be taught as early as the Junior year. For this purpose the book is in a class by itself. Practicing engineers will find that this second edition has brought up to date much material in the first edition which has now become obsolete, thus adding to the reference value of the book.

Chemical Engineer's BOOKSHELF

Chemical Engineering In the Making

CYANIDATION AND CONCENTRATION OF GOLD AND SILVER ORES. *By John Van Nostrand Dorr.* Published by the McGraw-Hill Book Co., New York City. 485 pages. Price, $5.

Reviewed by *H. C. Parmelee*

CYANIDATION of gold and silver ores is an art that involves the application on a large scale of chemical engineering principles. The marvelous efficiency of the process is indicated by the fact that a fraction of an ounce of gold may be won from a ton of ore at a high rate of recovery and a substantial profit. Like all chemical engineering processes, cyanidation is a combination of unit operations in appropriate sequence. It involves crushing, grinding, classification, agitation, thickening, and precipitation. Several of these operations, notably classification and thickening, were originally developed for the cyanide process and there brought to a high state of efficiency. The equipment devised for the purpose, however, is of such general utility that it has found wide adoption in other metallurgical and industrial processes.

Mr. Dorr's book is the first important contribution to the literature in fifteen years, and the time is ripe for its appearance. Following an introductory historical chapter, the author discusses the examination and testing of ores. The outline of procedure is adequate for those who are qualified by training and experience to conduct their own tests. Preparation of ore for cyanidation is covered in four chapters on coarse crushing, sorting, fine grinding, and classification. Sand and slime treatment are given extensive consideration, including description of types of equipment and examples of practice. Other chapters are devoted to cyanidation of gravity and flotation concentrates, bullion recovery, and plant control.

Of special interest is the chapter on the treatment of simple and complex ores, in which details of practice are given for about 50 mills in all parts of the world handling a variety of ores. Attention is given to ores containing arsenopyrite, copper, pyrrhotite, tellurides, and base metals, as well as to simple ores of gold and silver. The treatment of old residues is covered in a separate chapter. Costs and power consumption are given for a large number of mills in different parts of the world. The final chapter contains reference information and data. Numerous flowsheets and illustrations give added value to the text.

Two factors combine to make Mr. Dorr's book an exceptionally complete treatise on the subject: First, his personal experience in, and his contributions to, the art of cyanidation, and second, his world-wide acquaintance with metallurgists who have cordially cooperated with him. The book should be recognized as the standard work on cyanidation for some time to come.

Eight Thousand Alloys

ENGINEERING ALLOYS. By *Norman E. Woldman* and *Albert J. Dornblatt.* Published by the American Society for Metals, Cleveland, Ohio. 622 pages. Price, $10.

IT WOULD BE hard to find anywhere a more complete cataloging of engineering alloys, their compositions, properties, uses and manufacturers. Not only does the book cover completely the American alloy field, but it includes a large part of the foreign field as well.

The entire book is in table form. In one section, the 8206 alloys are listed alphabetically according to trade name, along with composition, physical properties, uses, manufacturer and special remarks. Another section is given over to classification of the same alloys according to typical uses or special characteristics. Still another section contains an alphabetical listing of manufacturers with a summary of the alloys that are produced by each. In a final appendix, all the corrosion and heat resistant alloys are brought together and classified according to chemical composition.

This book represents a very admirable first attempt to bring together and correlate a huge mass of data which heretofore, if available at all, has only been in the form of a scattered multitude of individual manufacturers' catalogs, partial indexes and abstracts. For the purpose of making a complete reference book, the authors, have even included some alloys which are either obsolete or no longer produced commercially.

Analysis by Fluorescence

FLUORESCENCE ANALYSIS IN ULTRA-VIOLET LIGHT, Second Edition. By *J. A. Radley* and *Julius Grant.* Published by D. Van Nostrand Co., New York City. 326 pages. Price, $7.

FLUORESCENCE analysis has in recent years become an important tool, both of the research investigator and of the practical analyst. However, as the authors pointed out in their first edition, the methods included in this technique have had so decided a vogue that they have sometimes been employed where other methods would have been preferable. The purpose of the first edition was, therefore, to appraise the then existing state of the art, and clarify the particular field of this technique.

In the preparation of the second edition, the authors were able to digest a great deal of additional material and have produced a book in which the applications of this interesting method to a great variety of problems have been explained.

The book commences with a brief theoretical introduction followed by a discussion of the best methods of producing, filtering and measuring ultraviolet light. Giving directions in regard to the most reliable means for making the analyses themselves, the authors discuss the actual applications at considerable length in every important field in which fluorescent methods have been successfully applied.

New Textbook

ORGANIC CHEMISTRY. By *Lucius Junius Desha.* Published by McGraw-Hill Book Co., New York City. 750 pages, Price, $3.75.

Reviewed by *Clarence G. Derrick*

IN WRITING this book for the usual one-year course, the author states, "The guiding policy has been to consider compounds, if, when, and as they serve usefully to illustrate and explain the general principles of organic chemistry." No division is made between aliphatic and aromatic compounds, as was characteristic of the well-known text by W. A. Noyes.

The descriptive matter of each chapter is followed by a discussion of qualitative organic analysis and by a complete set of review questions and problems. The outstanding characteristic of

the text is the exceptionally well-presented discussions of industrial organic chemistry in a much more readable form than is usual. Such a text requires that the accompanying lectures must emphasize mainly the fundamental principles of chemistry, physics and mathematics as applied to organic chemistry.

This is an exceptional book by one who must be an inspiring teacher.

Introduction to Plastics

THE TECHNOLOGY OF PLASTICS. By *H. W. Rowell.* Published by Plastics Press, Ltd., Ludgate Hill, London. 206 pages. Price, 10 d.

Reviewed by *A. F. Randolph*

IN THIS small book, of hardly more than pocket size, the author has effectively achieved his purpose of presenting a general introduction to the technique of plastics, suitable as a textbook in technical colleges. The subject matter follows closely the syllabus proposed by the Institute of the Plastics Industry for the course now being given by three such schools in England (*British Plastics and Moulded Products Trader,* 8, p.156, 1936). To the technical student, or to the graduate technician, or even the executive, unfamiliar with this field, the book successfully presents the essentials of the subject, not heretofore available in such compact form.

In laying emphasis principally upon molding technique and equipment, the author covers much the same ground as did Rahm (Plastic Moulding, by L. F. Rahm, McGraw-Hill, 1933). One might wish for fuller treatment of the nature and production of certain of the materials themselves. But, considering the stated scope of the work, one should not cavil at the omissions. Nor does this reviewer find any important errors.

Mineral Statistics

THE MINERAL INDUSTRY DURING 1935. Edited by *G. A. Roush.* Published by the McGraw-Hill Book Co., New York City. 754 pages. Price, $12.

STATISTICAL data and technical progress in the industry are again brought up to date by Mr. Roush in his well-known annual. The book follows the high standards of its predecessors in reporting domestic and foreign production, consumption, trading, markets and prices, for all of the important mineral commodities.

Powerhouse Helps

POWER OPERATOR'S GUIDE (1001 Practical Helps). Compiled and edited by *E. J. Tangerman.* Published by McGraw-Hill Book Co., Inc., New York City. 568 pages. Price, $4.

DESCRIBED BY the publishers as a "compilation of ideas, methods and tools for saving time, labor and money in the power plant, and along the line of power services," this book consists of an edited collection of the best short practical "kinks" published in the magazine *Power* during the years 1928-34. Although it is aimed at the man in the power plant, many of its suggestions will undoubtedly prove interesting to chemical engineers, especially those in organizations where strictest separation of responsibility between powerhouse and plant is not practiced. Those sections dealing with power services and with the application and transmission of power should be particularly useful to engineers engaged in plant operations.

Preventing Plant Fires

CROSBY-FISKE-FORSTER HANDBOOK OF FIRE PROTECTION, Eighth Edition. Edited by *Robert S. Moulton.* Published by National Fire Protection Association, International, Boston, Mass., and D. Van Nostrand Co., New York City. 1153 pages. Price, $4.50.

THIS HANDBOOK which appeared first in 1896 and has previously been published privately, has in its latest edition been compiled and published by the National Fire Protection Association and reviewed by a committee appointed by this organization's board of directors, thus assuring its authority. It covers the field of fire protection in a logical manner, going into the fundamentals of fire protection, statistics on fire loss and loss of life through fires, organizations concerned with fire protection, laws and regulations, types of hazards and their eliminations, fire restricting construction, fire retardant treatments, fire protection equipment, organization of plant fire departments, and salvaging operations. A consider-

RECENT BOOKS AND PAMPHLETS

Recent Advances in General Chemistry, by Samuel Glasstone. P. Blakiston's Son & Co., Philadelphia, Pa. 430 pages. Price, $5. A condensed and simplified account of recent outstanding monographs and original papers in the field of general chemistry.

Recent Advances in Physical Chemistry, by Samuel Glasstone. Third Edition. P. Blakiston's Son & Co., Philadelphia, Pa. 477 pages. Price $5. Most important new matter in this edition is section on application of quantum mechanics to problems of valency.

Rotary Drilling Handbook, by J. E. Brantly. Published by Russell Palmer, New York City. 304 pages. Price, $3.50. A practical handbook of short-cuts, reference tables and simplified formulas for the non-technical man on the oil derrick.

Distillation, by Joseph Reilly, National University of Ireland. Chemical Publishing Co. of N. Y., Inc., New York City. 120 pages. Price, $1.25. A monograph summarizing recent developments in theory and practice.

The Chemistry of Rubber, by H. Freundlich, University College, London. Chemical Publishing Co. of N. Y., Inc., New York City. 72 pages. Price, $1.25.

Wrought Iron, Its Manufacture, Characteristics and Applications, by James Aston and Edward B. Story. A. M. Byers Co., Pittsburgh, Pa. 59 pages. Price, $1. Complimentary copies may be obtained by sending request written on company letterhead to A. M. Byers Co.

Procedure Handbook of Arc Welding Design and Practice, Fourth Edition. The Lincoln Electric Co. 819 pages. Price, $1.50. The 223 new pages in this edition include material on characteristics of the welding generator, selection of type of joint, insurance, welding codes, arc cutting, polarity of welding current, horizontal welds, sheet metal welding, effect of electrode size on welding cost, methods of testing weld metals, 4-6 chrome steel, monel metal, plate girders, and principles of surfacing by welding.

The Cracking Art in 1935, by Gustav Egloff, Emma E. Crandal and Martha M. Doty. Universal Oil Products Co., Chicago, Ill. UOP Booklet No. 188. 351 pages. Progress in petroleum cracking during 1935. Includes complete patent survey and review of current literature.

Jute and Substitutes, by N. C. Chaudhury, Third Edition. W. Newman & Co., Ltd., Calcutta, India. American agent, Chemical Publishing Co. of N. Y., Inc. 249 pages. Price, $5. A treatise on the cultivation, chemistry, processing and trade in jute and jute substitutes.

Candle Manufacture, by N. N. Godbole, Benares Hindu University, Benares, India. American agent, Chemical Publishing Co. of N. Y., Inc., New York City. 29 pages. Price, $1.50. Raw materials and manufacture of candles, with special reference to tropical climates.

Iron and Steel Wire, a Bibliography, compiled by R. H. Phelps, Technology Department, Carnegie Library of Pittsburgh. Mimeographed, 68 pages. A very complete list of books and journal articles on the subject. Gives specific page references as well as nature of material there presented.

Zinc Coating (Hot Galvanized), a Bibliography, compiled by V. S. Polansky, Technology Department, Carnegie Library of Pittsburgh. Mimeographed. 110 pages. Similar to above. Covers period since 1910.

The Steel Physical Properties Atlas, by Charles N. Dawe, American Society for Metals, Cleveland, Ohio. 87 pages. A compilation of physical test data for 40 of the common types of plain carbon and alloy steels. Presented in attractive and convenient graphical form.

The Development and Application of the Continuous Lead Refining Process, by G. K. Williams. McCarron, Bird & Co., Melbourne, Australia. 122 pages.

Cosmetic Dermatology, by Herman Goodman. McGraw-Hill Book Co., New York City. 591 pages. Price, $6.50. Dictionary of ingredients; discussion of anatomic, physiologic, and pharmacologic bases of cosmetic application; "shelf tested" formulary; and appendices on odor and color in cosmetics.

How to Find Metallurgical Information, edited and published by Richard Rimbach, Pittsburgh, Pa. 32 pages. Price, $1. Lists all possible sources of metallurgical information with notes on where to find them and how to use them.

Preparation of Scientific and Technical Papers, Third Edition, by Trelease and Yule. Williams & Wilkins Co., Baltimore, Md. 125 pages. Price, $1.50. Suggestions on style and preferred forms of presentation used in scientific papers.

Symposium on High-Strength Constructional Metals, papers and discussions presented at the seventh regional meeting of the American Society for Testing Materials, Pittsburgh, March 4, 1936. Published by the American Society for Testing Materials, Philadelphia, Pa. 126 pages. Price, cloth bound, $1.50; paper bound, $1.25.

Proceedings of the Chemical Engineering Group of the Society of Chemical Industry, Vol. 17, 1935. 56 Victoria Street, London, S.W.1. A group of British papers on varied subjects of chemical engineering interest.

Collected Papers From the Faculty of Science, Osaka Imperial University, Series C, Chemistry, Vol. 3, 1935. Osaka Imperial University, Osaka, Japan.

able part of the information given is directly, and in some cases specifically, applicable to chemical engineering industries. There is, for example, an extensive table of properties of hazardous and flammable chemicals. Consequently, the book is useful not only to professional fire-fighters, but also to engineers who are responsible for preventing and mitigating fire damage in chemical plants.

Recent Foreign Books

GRUNDZUEGE DER CHEMIE UND SYSTEMATIK DER KOHLEN. By *Ing. D. J. W. Kreulen.* Verlag: D. B. Centen's Uitgevers-Mij, Amsterdam-C., Holland. 179 pages.

Reviewed by *A. P. Hartlapp*

THE AUTHOR seems to have served a twofold purpose with this treatise. In the first place, he presents a bird's eye view of the chemistry of coals, introducing to the student as well as to the chemical engineer the frequently used terms employed in the specialized technical books. Only the most typical experiments are mentioned. At the end of each chapter, lists of the latest reference books are given.

In the second place, the author has set forth his interpretation of the constitution of hard coal extracts, and of the real bitumen contents of hard coal. This is of special value to the engineer reading German, as most of the treatises thus far have been published only in the Dutch language.

FABRICATION VON ABSOLUTEM ALKOHOL ZWECKS VERWENDUNG ALS ZUSATZMITTEL ZU MOTOR-TREIBSTOFFEN. By *M. Klar.* Published by Wilhelm Knapp, Halle. 84 pages. Price, paper bound, RM 4.20.

Reviewed by *V. J. Peissachowitz*

THE series of the well known monographs on industrial methods of the chemical industry has certainly gained in importance by the above monograph. The author gives a splendid review of the industry of absolute alcohol as admixture to motor fuel, and analyzes the various industrial methods applied, both from the technical and commercial points of view. The collection of the scattered literature and the quotation of all issued patents will be appreciated by those interested in this question.

ANALYTISCHE CHEMIE DER EDELMETALLE. By *Alfred Wogrinz.* Published by Ferdinand Enke, Stuttgart, Germany. 141 pages. Price, paper cover, RM 13; bound, RM 14.80.

Reviewed by *C. M. Hoke* and *A. P. Sachs*

WHEN WE CONSIDER the extensive uses of precious metals in industry, it is not surprising that chemists in general practice, as well as those in refineries, mints, and assay offices, should need information concerning them. This handbook gives analytical methods for a wide range of industrial products, such as photographic materials, dental and jewelry alloys, plating baths, smelters' samples, etc. Brief historical notes, physical and chemical properties, and other useful data concerning silver, gold, and the platinum metals are given. The bibliography is excellently suited to the needs of the general worker.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Liquor Laws, compiled by Elmer A. Lewis. Document Room, House of Representatives; 15 cents.

Engineering Control of Occupational Diseases, by J. J. Bloomfield. Public Health Service Reprint No. 1749; 5 cents.

Acute Response of Guinea Pigs to Vapors of Some New Commercial Organic Compounds, Part X, Hexanone (Methyl Butyl Ketone), by H. H. Schrenk and others. Public Health Service Reprint 1747; 5 cents. Part XI, Secondary Amyl Acetate, Public Health Service Reprint 1756; 5 cents.

Compilation of Laws Relating to Mediation, Conciliation, and Arbitration Between Employers and Employees, Laws Disputes Between Carriers and Employers and Subordinate Officials Under Labor Board; Eight-Hour Laws; Employer's Liability Laws; Labor and Child Labor Laws, compiled by Elmer A. Lewis. Document Room, House of Representatives; 20 cents.

Labor Laws and Their Administration, Bureau of Labor Statistics Bulletin 619; 20 cents. Proceedings of the twenty-first convention of the International Association of Governmental Labor Officials, Asheville, N. C., October, 1935.

Annual Report of the Board of Regents of the Smithsonian Institution, Year Ending June 30, 1935. Smithsonian Institution Publication 3348; $1.00 (paper cover), 580 pages.

Industrial Property Protection Throughout the World, by James L. Brown. Bureau of Foreign and Domestic Commerce, Trade Promotion Series 165; 20 cents.

Market Research Sources, by Rachel Bretherton. Bureau of Foreign and Domestic Commerce. Domestic Commerce Series 55, 1936 edition; 25 cents. A guide to information on domestic marketing.

National Income in the United States, 1929–35. Bureau of Foreign and Domestic Commerce unnumbered document; 25 cents.

Glossary of Hides and Skins, Leather and Leather Goods and Allied Products Exported and Instructions to Exporters, 1936, by J. G. Schnitzer. Bureau of Foreign and Domestic Commerce, Leather and Rubber Division Special Circular 1243; mimeographed.

Supplement to List of Publications, Bureau of Mines, July 1, 1935 to June 30, 1936, with Subject Index. Bureau of Mines.

Consumption of Primary and Secondary Tin in the United States in 1935, by E. W. Pehrson and others. Bureau of Mines Information Circular 6930; mimeographed.

Disposal of Oil-Field Brines in the Arkansas River Drainage Area in Western Kansas, by C. J. Wilhelm and others. Bureau of Mines Report of Investigations 3318; mimeographed.

Underground Mill at the Doyle Mine, Shullsburg, Wis., by Wing G. Agnew. Bureau of Mines Information Circular 6908; mimeographed. New technique modifying succession of unit operations.

Flotation of Vermont Talc-Magnesite Ores, by J. B. Clemmer and S. R. B. Cooke. Bureau of Mines Report of Investigations 3314; mimeographed.

Pebble Phosphate Accident Experience, by F. E. Cash and C. P. Dempsey. Bureau of Mines Information Circular 6917; mimeographed.

List of Devices for Respiratory Protection Approved by the U. S. Bureau of Mines, by W. P. Yant. Bureau of Mines Information Circular 6918; mimeographed.

The Improved Permissible Flame Safety Lamps, by L. C. Ilsley and others. Bureau of Mines Report of Investigations 3312; mimeographed.

Investigations During 1935 of Combustibles in Manholes in Boston, Mass., by G. W. Jones and others. Bureau of Mines Report of Investigations 3321; mimeographed.

Tabular Summary of State Specifications for Liquid Asphaltic Road Materials, in Effect January 1, 1936. Bureau of Mines; mimeographed.

Basic Industrial Markets in the United States. Market Research Series No. 14.1, the Textile Industries. United States Department of Commerce, Bureau of Foreign and Domestic Commerce. 10 cents.

Cost of Distribution of Electricity, Power Series No. 3, national power survey report by Federal Power Commission. 147 pages. 35 cents.

Statistics of Electric Generating Plants in the United States, Power Series No. 6, national power survey report by Federal Power Commission. 156 pages. Power output figures for 1920-1935, inclusive, classified according to year, state, and class of ownership.

Naval Stores Report. Bureau of Agricultural Economics; mimeographed. Semi-annual report on production, distribution, consumption, and stocks of turpentine and rosin of the United States, April 1, 1936—Sept. 30, 1936.

Identification, History, and Distribution of Common Sorghum Varieties, by H. N. Vinall and others. Department of Agriculture Technical Bulletin 506; 25 cents.

Water Levels and Artesian Pressure in Observation Wells in the United States in 1935, by O. E. Meinzer and L. K. Wenzel. U. S. Geological Survey Water-Supply Paper 777; 30 cents.

Mineral Resources of the Region Around Boulder Dam, by D. F. Hewett and others. Geological Survey Bulletin 871; 45 cents.

Engineering Geology and Mineral Resources of the Tennessee Valley Authority Region, by Edwin C. Eckel. Tennessee Valley Authority Geologic Bulletin No. 1.

Mineral Deposits of the Ruby-Kuskokwim Region, Alaska, by J. B. Mertie, Jr., U. S. Geological Survey Bulletin 864-C; 25 cents.

Silver: Its Properties and Industrial Uses, by B. A. Rogers and others. Bureau of Standards Circular 412; 10 cents.

Abrasive Grain Size. Bureau of Standards Simplified Practice Recommendation R118–36; 5 cents.

Paper Specifications. Amendments have been issued revising a number of Federal Specifications governing the purchase of various kinds of paper.

Fiber and Cardboard. New Federal Specifications for: Boxes, fiber, solid, LLL-B-636a; Boxes, fiber, corrugated, LLL-B-631a; Pressboard, colored, UU-P-701, Amendment No. 1; 5 cents each.

Federal Specifications. New or revised specifications on: Cylinders, steel, seamless, type 3A (for compressed gases), RR-C-901; Tires, automobile and motorcycle, pneumatic, ZZ-T-381b; Tubes, automobile and motorcycle, inner, ZZ-T-721b; Matches, safety (full size, in boxes), EE-M-101a Amendment 2; Gelatin, C-G-191, Amendment 1; Brick, paving, SS-B-671, Amendment 3; Tile, acoustic, SS-T-302, Amendment 1; 5 cents each.

Your Plant NOTEBOOK

PRESSURE GAS STORAGE STATION OPERATES AUTOMATICALLY

Staff Report

THROUGH the cooperation of the Chicago Bridge & Iron Works we are privileged to publish a brief description of the means for automatic regulation of gas storage and distribution employed by a large middle-Western gas company at a point 32 miles from the plant where the gas is produced. The storage holder, a Hortonsphere built by the Chicago concern, was installed in order to assure continuous gas service in the neighborhood of the storage station in the event of low pressure on the transmission line, due either to heavy load or to transmission line breakage. It has operated successfully for a number of years, the automatic controls having made a minimum of supervision of the station and equipment necessary.

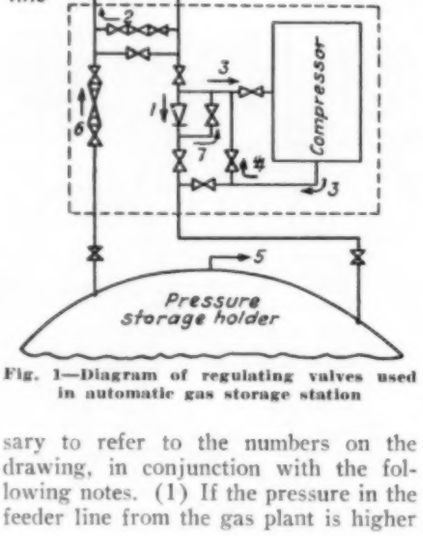


Fig. 1—Diagram of regulating valves used in automatic gas storage station

The diagram of Fig. 1 illustrates concisely how the regulating equipment works. To understand the functions of the several automatic valves it is necessary to refer to the numbers on the drawing, in conjunction with the following notes. (1) If the pressure in the feeder line from the gas plant is higher than the holder pressure, gas will flow to the holder. (2) If the pressure in the feeder line exceeds some predetermined pressure such as 7 lb., the back pressure regulator will pass gas directly to the local distribution mains. (3) If the pressure exceeds some predetermined pressure such as 12 lb., the compressor will cut in and pump gas into the holder until it again cuts out at some set pressure such as 45 lb. (4) If the compressor discharge pressure goes above some such set pressure as 50 lb., the back pressure regulator, which acts as a relief valve, will bypass the gas back to the feeder line. (5) Should the holder pressure go above 60 lb., or other predetermined pressure, a relief valve on the holder will relieve to the atmosphere, having given an alarm at 55 lb. (6) When pressure on the local distribution line drops to 5 lb. or other set pressure, a reducing regulator passes gas from the holder to the distribution line. (7) If a break should occur in the feeder line between the control station and the gas plant, this section of the feeder can be shut off and the gas from the holder bypassed around the check valve and back into the feeder to provide intermediate service.

In Fig. 2 the interior of the station appears, with the regulating valves in the center and the recorders at the right. The compressor is at the left, just out of the picture.

Fig. 2—Interior of the pressure storage station, showing regulating valves and recorders

Colloidal Graphite Protects Lamp Bases

By E. A. Bodine
Acheson Colloids Corp.
Port Huron, Mich.

CORROSIVE GASES and other foreign bodies in the air of factories, as well as the dampness which usually prevails in cellars and storehouses, are responsible for the corroding of incandescent lamp bases in their sockets. Salt air aboard ship and along the seaboard is also likely to be a source of trouble in this respect.

The difficulty can readily be overcome by applying colloidal graphite suspended in water to the threaded portion of the lamp base. This forms a tenacious and homogeneous film of graphite and creates not only an efficient dry lubricant, but a valuable anti-corrosive agent, as well.

The surface to be treated, after being cleaned of any greasy substance, can be covered with colloidal graphite simply by spraying or brushing. Lamps and fuse plugs so treated should not be screwed into their sockets until the graphite film has had time to become thoroughly dry.

New Trends in Evidence at National Power Show

MANY DEVELOPMENTS of the past two years were displayed for the education and enlightenment of mechanical, chemical and electrical engineers at the 12th National Exposition of Power and Mechanical Engineering which was held in New York during the week of November 30, coincident with the annual meeting of the American Society of Mechanical Engineers. *Chem. & Met.'s* interest in the Show, as in the past, was centered in that equipment most likely to interest chemical engineers. Most of what was displayed has already been described in our pages and hence can receive only passing comment here. Others of the new developments will be more fully described in the equipment pages of this and later issues.

A trend which was noted at the 11th Show two years ago and one considered unfortunate by most engineering visitors, was even more pronounced this year. That is the virtual disappearance of heavy equipment from exhibitors' booths. A heavy-duty pulverizer, a medium-size stoker and several tremendous valves were substantially the only large features, with the exception of the machine tools, which appear to be increasing in importance as a Power Show feature. With the exceptions noted, most of the heavy equipment normally associated with the power plant was conspicuous by its absence. Several prominent turbine manufacturers were not at the Show at all, while another showed no turbines. Boiler manufacturers contented themselves with photographs and drawings. All in all, the Show has lost much of the spectacular character which formerly made it such a colorful exposition. Still another trend was evident in that very little new equipment was actually announced at the Show, for most of the recent developments on display had already been publicized. On the other hand, however, more than usual attention was given to the clothing of exhibits in expensive modern dress. Then, too, since its 1934 low, the Show has grown considerably in size, with about 260 exhibitors—not counting subsidiaries exhibiting in the same booths, societies and publishers—in comparison with about 200 in the earlier year.

What many power engineers felt to be the most significant disclosure of the week was not displayed at the Power Show, but instead was described at a meeting of the American Society of Mechanical Engineers. This device, the "Steamotive," is a forced circulation, self-contained, high-pressure steam generating unit of extremely compact design and high efficiency, developed jointly by the General Electric Co., Babcock & Wilcox Co., and the Bailey Meter Co. The description of "packaged power plant" given the Steamotive is apt, for one unit now in operation at 21,000 lb. of steam per hour and 1,500 lb. pressure was shipped to the user complete with auxiliaries on a single railroad flat car. The furnace of the new boiler is completely water-walled and the burners supplied with preheated air under forced draft. Feed water passes from the 2,000-lb. feed pump through the water walls and boiler screen to a separator from which the unevaporated water is returned through a heat exchanger and hot well to the feed pump. Dry steam passes through a superheater and thence to the equipment using the steam. The new generator is stated to be particularly applicable to installations where space is strictly limited, although many engineers feel that a still wider field is in store for it.

Another development of broad significance, the "moving pipeline" conveyor displayed by Johns Conveyor Corp., Newark, N. J., was described in detail on page 610 of the November, 1936 issue of *Chem. & Met.*

New Instruments

As at every power and chemical show in recent years, the booths of the instrument manufacturers showed signs of intense activity in this field. American Meter Co., New York, exhibited a new portable Gravitometer for measuring the specific gravity of gases, similar in principle to, although differing widely in detail from, the earlier non-portable machine described in August, 1933, issue of *Chem. & Met.* The Bristol Co., Waterbury, Conn., displayed a new recording voltmeter with a suspended movement; a thermocouple-operated device for detecting the extinguishment of gas pilot flames; a non-hunting potentiometer recorder-controller; a round-chart potentiometer pyrometer recorder with a new simplified electronic actuating movement; and a photoelectric temperature measuring instrument of extreme rapidity of action, given the name of Electronic Instagraph. The last employs a Photronic cell and measures only certain bands of radiation. So far, it has been applied only to measuring the temperature of rapidly moving billets in steel mills.

A new diaphragm-type draft measuring element for multiple draft gages was an important feature of the exhibit of the Bailey Meter Co., Cleveland, Ohio. The new unit, said to be of extreme sensitivity, owes its success in large part to a new membrane material used in the diaphragm, which is extremely thin, impervious and free from internal resistance. This company showed an improved electrical transmission system for indicating, recording or integrating at a distance from the measuring instrument. Several receivers may be operated from a single transmitter.

Brown Instrument Division, Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., showed representative members of the new line of Air-O-Line air-operated controllers which have already been described in *Chem. & Met.* This company also demonstrated an improved form of electronic relay for preventing pilot flame failure.

Builders Iron Foundry, Providence, R. I., demonstrated an improved indicating, recording and integrating conveyor scale in which a section of conveyor belt was weighed by means of a Toledo scale mechanism and the indication transmitted to a remote point by means of a Chronoflo electrical transmitting mechanism. The remote integrating device was driven in synchronism with the belt and the belt tare continuously weighed on the return side of the belt and subtracted automatically from the gross weight at the recording point, thus avoiding inaccuracy resulting from material sticking to the belt. This concern also showed a set-up employing one of the proportioning pumps made by its associated concern, Proportioneers, Inc., controlled by a Chronoflo flow meter to give periodic "shots" of a treating material in proportion to the measured flow of another material. The method is intended for the treating of large flows with small quantities of treating material, and has been suggested for use in a "shot feed" method of boiler treatment.

Among the several devices of recent development exhibited by the Foxboro Co., Foxboro, Mass., was the Vernier Valvactor, a device for accurately positioning control valves in association with another controlling instrument; a manual control for diaphragm valves; and an electric potentiometer Stabilog which gave a strip chart record of the

deviations in control. A new automatic gas analyzer, known as the Orsatomat, was shown by the Hays Corp., Michigan City, Ind. This instrument is described elsewhere in this issue. Another version of the Orsatomat, which incorporates continuous recording of the CO_2 content of gases, was displayed.

Improved appearance of its instruments was an important feature of the display of the Republic Flow Meters Co., Chicago, Ill. A redesigned line of CO_2 meters was displayed together with a type of recording thermometer which now employs this company's "Cartridge-Sealed" construction. The Sarco Co., New York, had on display new regulators for controlling the mixing of steam and water and a new electric thermostat and motor valve for temperature control. C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., exhibited a new non-hunting type of photoelectrically balanced potentiometer.

Taylor Instrument Cos., Rochester, N. Y., featured a new optically improved glass tubing for industrial thermometers which gives a much broader angle of vision than the usual tubing. The new Motosteel control valve, which features one-piece welded steel construction was also on display, together with a new valve positioner, indicating controller and flowmeter integrator.

Power Transmission

Manufacturers of power transmission equipment, notably those making variable speed transmissions, showed evidence of much recent activity. Allis-Chalmers Mfg. Co., Milwaukee, Wis., exhibited two versions of its Vari-Pitch V-belt sheave. The Dayton Rubber Mfg. Co., Dayton, Ohio, showed a completely oil-proof V-belt, the casing of which is impregnated with Duprene.

A variable speed transmission operating on an entirely new principle was shown by Graham Transmissions, Springfield, Vt. The new unit, which is of extreme simplicity, permits speed variation from a maximum through zero to reverse, and consists of a cage carrying three tapered rollers, the rollers having pinions at one end meshing with an internal gear connected to the output shaft. The cage, turning at motor speed, rotates the rollers which in turn roll on a stationary contact ring whose position can be varied lengthwise of the machine to control the speed of the internal gear and output shaft.

The New Departure Mfg. Co., Bristol, Conn. showed its new Transitorq variable speed transmission applied to a tension-controlled rewind. Another new drive already noted in *Chem. & Met.'s* pages was the Vari-Speed Motodrive of the Reeves Pulley Co., Columbus, Ind.

Another new variable speed transmission was shown by Power Master Drives, 25 East 4th St., New York. This device is a new version of the V-belt and cone-disk pulley mechanism, consisting of two belts, three shafts and four pulleys. The driving and driven shafts carry conical-disk pulleys, the diameter of which is not changed. An intermediate shaft, the center of which can be moved through an arc by the speed-control handle, carries a double conical-disk pulley, one pulley being belted to the driven and one to the drive shaft. Oscillation of the intermediate shaft automatically alters the diameters of the two pulleys to give the desired speed variation.

Steam Equipment

Very few developments in this classification gave evidence of novelty. Among traps, it was clear that the trend toward the use of thermostatic air release was continuing. A novel trap, making use of the thermodynamic properties of steam, was shown by the Yarnall-Waring Co., of Philadelphia. Armstrong Machine Works, Three Rivers, Mich., displayed a new small-sized forged-steel trap for pressures to 450 lb. Among the valves, most of those shown have been on the market for a number of years. The Homestead Valve Mfg. Co., Coraopolis, Pa., showed its improved lifting-plug type of plug valve. One new expansion joint was shown, that of the Foster Wheeler Corp., New York. It employs a bellows-like element formed of eight annular stainless steel disks, alternately welded at the inner and outer peripheries.

Fans

Foster Wheeler Corp., New York, showed an axial flow fan of large diameter, completely forged from Dow metal. The Hartzell Propeller Fan Co., Piqua, Ohio, exhibited its new Charavay "Birdwing" fan, a quiet type of peculiar design, the blades being patterned after the open wing of a bird. The L. J. Wing Mfg. Co., New York, demonstrated a three-blade fan with adjustable pitch, designed for ready adjustment to special requirements of air capacity or motor horsepower.

Miscellaneous

Foster Wheeler Corp., New York, also showed a new type of head joint for high pressure heat exchangers, known as the "Lockhead." In this head, the pressure load is cared for independently of the gasket and the gasket joint is relieved of all load except that to maintain a tight joint. This company also showed a small gas- or oil-fired Dowtherm generator, for producing Dowtherm vapors at temperatures up to 750 deg. F.

Schramm, Inc., West Chester, Pa., exhibited several new and improved air compressors, designed along the lines of an automobile engine. The new compressors feature built-in electric motors and operate at speeds up to 1,200 r.p.m., making them extremely compact.

A new type of filter for removing chips or fibrous materials from liquids was shown by the Cuno Engineering Corp., Meriden, Conn. The new design incorporates a backwash feature without loss of backwash fluid. The filter drum is wire-wound and the drum rotates continuously over a backwash fitting, through which a small amount of the filtered liquid is continuously forced by means of a secondary pump.

A novel construction which has been developed for power plant use, but which may very possibly have other applications, is the conical coal distributor offered by the Stock Engineering Co., Cleveland, Ohio. In distributing coal from overhead hoppers across the width of a boiler furnace stoker hopper, it has been noted that segregation takes place in an ordinary distributor, with the larger pieces of coal going to the sides. The new distributor is bent so as to form a portion of a cone and has been shown both on theoretical grounds as well as by actual demonstration to produce a uniform distribution of particles.

Several new lighting improvements were shown by one manufacturer, the Benjamin Electric Co., Des Plaines, Ill. Among these was a new combination mercury vapor-incandescent lamp giving a light very similar to daylight. Another light, a so-called artificial skylight, attained extremely high lighting intensity at the working level, totally without glare.

Among electrical equipment, several new motor controllers were noted. Allis-Chalmers Mfg. Co., Milwaukee, Wis., showed a new 150-kw. mercury arc rectifier for applications requiring a small amount of rectified current. General Electric Co., Schenectady, N. Y., exhibited the new Tungar arc welder, a low-cost, compact, direct-current welder for light steel parts, employing electronic tubes as the rectifying means.

American Blower Corp., Detroit, Mich., demonstrated a unique type of dust collector for fly ash and other coarse dusts. The primary separator is a cylindrical cell containing a spinner to impart a rotating action to the dust-laden gases, throwing the heavier dust to the outside of the cell, where it is skimmed off. The clean gas at the center discharges to a fan or stack, while the dust-laden gas passes through a secondary cyclonic collector for final separation.

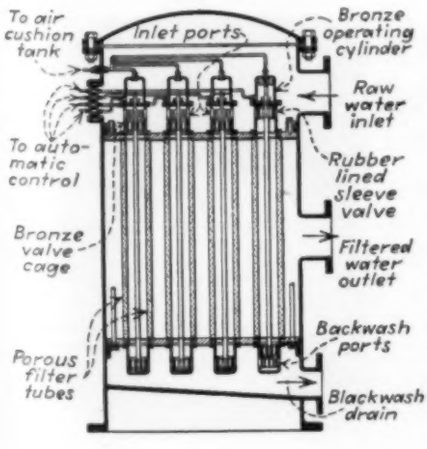
News of EQUIPMENT

Water Filter

Continuous flow of filtered water with automatic elimination of solids is possible with a new automatic water filter announced by the R. P. Adams Co., 220 Delaware Ave., Buffalo, N. Y. The filtering elements are stone tubes which may be supplied in various porosities, depending on the type of clarification desired. With the finest filter tubes and coagulation of suspended solids prior to filtration, it is said to be possible to produce crystal clear water.

The new filter, which has been given the designation AWF, is automatically controlled so that solids are eliminated from the filter surfaces every three minutes by a controlled backwash of 10 seconds. A longer cycle may be used if desired. Assuming the smallest size unit, with five-filter elements, one element is being backwashed while the other four are producing filtered water. Under automatic control a piston in an operating cylinder above the filter element is pushed upward at the proper interval by high pressure water or air. This closes the raw-water intake valve of the element, opening the backwash port and permitting filtered water to flow back through the element, washing accumulated sludge into the backwash drain. At the end of the backwash cycle, air under a pressure of 30 lb. returns the piston and valve to the filtering position.

Cross-section of automatic water filter



The new unit is available in six sizes ranging from 5x5 in. openings to 12x12 in. openings, with from 15 to 120 sq.ft. of filtering surface.

Automatic Orsat

"Orsatomat" is the name of a new automatic orsat gas analyzer recently developed by the Hays Corp., Michigan City, Ind. With the new device it is stated that a sample of flue gas can be analyzed in 20 seconds by simply operating a lever. Results are plainly indicated by a pointer moving on a

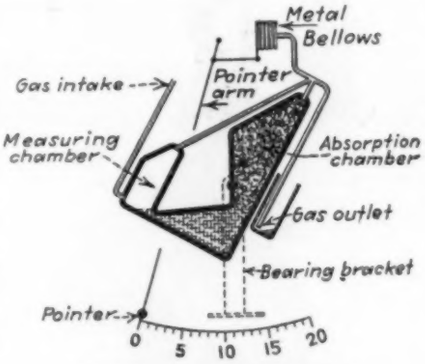


Diagram of new automatic orsat in sampling position

large, legible scale. The instrument requires neither manipulation of valves nor manual leveling or measuring.

The Orsatomat consists of a rotatable analyzing body which contains the measuring and absorption chambers and is charged with mercury and an absorbing chemical. In addition there is a metallic bellows and linkage for moving the pointer, an aspirator bulb and the necessary rubber tubing, all contained in a pressed steel case of special non-tipping design, fitted with a carrying handle. In use, the operator simply aspirates the sample into the instrument while it is in the sampling position. An automatic valve allows the gas in the sample to bypass so that it is always measured at atmospheric pressure. The rotatable part of the instrument is then shifted to the analyzing position, causing the mercury to displace the gas sample from the measuring chamber into the absorption chamber. Absorption of the CO_2 causes a shrinkage in the volume of the sample, creating a vacuum which is then indicated on the scale and read directly as per cent CO_2.

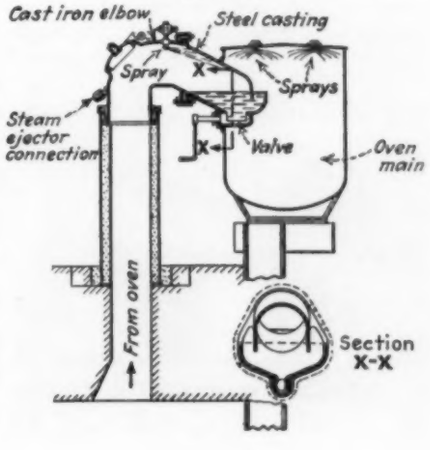
Resistant Alloys

Since the first *Chem. & Met.* announcement of the hard-facing and overlay metals manufactured by the Colmonoy Co., Los Nietos, Calif., in our October, 1935, issue, this concern has completed a number of other developments along the same lines. Among these are a number of new alloys, consisting of various base metals, alloyed with the new metallic boride crystal mixture developed by this company. These alloys are said to be cast easily and to fulfill stringent requirements in resistance to corrosion and abrasion. One of these is a steel-base alloy identified as Colmonoy No. 7. Although this has a hardness of 63-65 on the Rockwell C scale, when cast it can be annealed to machineable softness and rehardened to its original hardness. Another alloy, given the designation No. 6, has a nickel base and is practically impervious to the corrosive action of sulphuric, hydrochloric and other acids, as well as alkalis, according to the manufacturers. The company has also perfected a series of copper alloys having unusual physical properties as well as resistance to abrasion and corrosion.

Liquor-Sealed Valve

For use in byproduct coke ovens, a liquor-sealed standpipe valve which has no major moving parts and requires a minimum of space, has been announced by the Semet-Solvay Engineering Corp., 40 Rector St., New York City. The valve has been tested in actual operation for five years without expense for maintenance, replacement or repair, and on the basis of this record, two in-

Cross-section of liquor-sealed standpipe valve



stallations have recently been completed.

As appears from the accompanying sectional drawing, a standpipe lined with refractory material is connected by means of an elbow and liquor trap to the oven collecting main. Both the elbow and main are supplied with this company's liquor flush sprays. A Corliss plug cock in the bottom of the seal is closed when it is desired to seal off the standpipe from the main, the liquor collecting and completing the seal. When the valve is to be opened, the plug cock is turned so as to drain the liquor, whereupon the seal is lost and gas flows from the standpipe into the main.

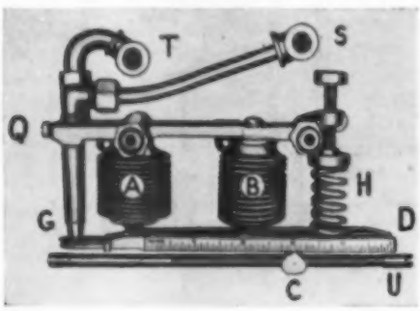
It is stated that only a minimum of daily attention is required in keeping this system in satisfactory operating condition.

Universal Controller

A new multi-purpose controller that can readily be adjusted over a wide range to operate in controlling temperature, pressure, vacuum, level, flow, speed or any other process variable which can be indicated at the controller as a pressure impulse, has recently been announced by Arca Regulators, Inc., 53 Locust Ave., Bloomfield, N. J. As the manufacturer points out, the advantage of this wide range of adjustability is that the instrument may be put to a new use if at any time the original use for which it was purchased becomes unnecessary. Furthermore, changes made in the process can readily be accommodated by the controller since its adjustment range is wider than that of any other instrument currently available.

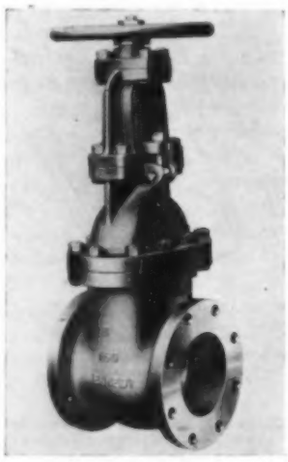
In the accompanying illustration *A* and *B* are metal bellows attached to a stationary support at their upper ends, and pivoted to bar *D* at their lower ends. This bar in turn pivots on fulcrum *C*. When a difference in pressures is the actuating means, as in flow control, both bellows are used and the fulcrum is placed between them by turning screw *U*. For variables that can be controlled by a pressure impulse in a single bellows—as temperature, pressure and vacuum—the fulcrum is placed in some position to the right of *B* and the second bellows is used as a compensator to prevent hunting. The bar *D* carries a flapper which, in contact with air nozzle *G*, serves to regulate the air pressure on a diaphragm control valve, and hence its opening. The amount of movement of the flapper for a given pressure change can be adjusted, it is evident, by varying the location of the fulcrum, thus suiting the controller to the requirements of the process.

Arca universal controller with case removed



Wedge Gate Valves

Kennedy Valve Manufacturing Co., Elmira, N. Y., has recently introduced a new line of standard iron-body wedge gate valves, the bodies of which are said to be 50 per cent stronger than ordinary cast iron. Special provisions have been taken to facilitate repacking. In order to prevent scoring and corrosion of the stem, heavy bronze bushings are employed wherever the stem passes through a cast-iron part. Hand wheel rims are of oval section, and have only five spokes for ready operation. Disks are of special design, reversible and interchangeable.

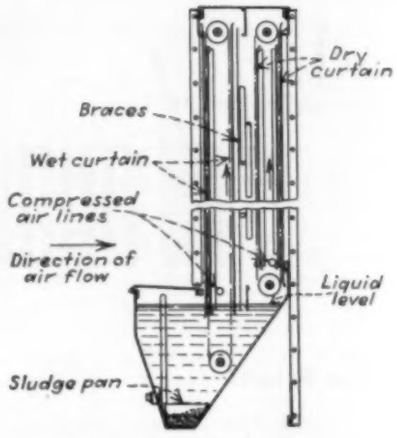


New iron body gate valves

These valves are made in all standard sizes to 60 in., for steam working pressures to 150 lb. and water pressures to 200 lb.

Impingement Air Filter

For removing dust and dirt from air in process plants and air conditioning installations, the Staynew Filter Corp., Rochester, N. Y., has developed a new automatic impingement type filter in which special attention has been given to the elimination of oil entrainment. As will be evident from the accompanying drawing, this is accomplished through the use of a pair of revolving curtains, the first one of which dips into the oil in the lower tank, while the second operates dry. Filters of this type generally employ but one curtain.



Cross-section of two-stage impingement air filter

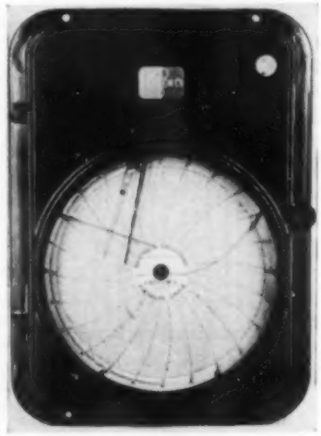
Air passing through the oiled curtain deposits its dust on the oiled surfaces, then passes through the dry curtain where any entrainment is removed. The second curtain also serves as a secondary defense against the passage of dust.

The filter operates automatically, is readily serviced and features an improved form of specially woven copper mesh for the curtains. This construction is said to insure a high degree of oil retention and to make for high air-cleaning efficiency.

Improved Recorders

A new line of round-chart recording voltmeters and ammeters, developed to fill the requirements of process plants where voltage and current records are needed, has been announced by The Bristol Co., Waterbury, Conn. The measuring elements are separate units which can easily be replaced. Both spring driven and electric clocks are

New recording pressure controller



available. Various sorts of cases may be supplied for different sorts of mountings.

This company has also announced a new series of low-range pressure recorders and controllers, given the designation Model D40M. These instruments are equipped with inclosed bell-type measuring elements and are offered for draft or pressure measurement in minimum ranges of 0 to 0.2 in. w.g. and maximum ranges of 0 to 2.0 in. Measuring elements are said to be highly accurate and able to respond instantly to scarcely perceptible pressure changes. For controlling purposes these instruments are equipped with this company's Free Vane type of pneumatic control. Sensitivity regulation is provided for adjustment of throttling range.

Equipment Briefs

Small size, low cost and compactness are features of a new line of lighting panelboards recently introduced by the Square D Co., Detroit, Mich. The cost of this equipment is said to be only slightly higher than equivalent fused panelboards, making it suitable for use in plant lighting circuits. The new panelboards are supplied with from 4 to 40 circuits for 115 or 230 volts a.c. service. Single pole branches are obtainable for 15, 20, 25 or 50 amp.

Capacities from 1 to 200 amp. can be handled in a new metal-bodied mercury switch recently introduced by Durakool, Inc., 1010 North Main St., Elkhart, Ind. The operating angle of the new switch is said to be less than 4 deg. Instead of a gas, a non-explosive liquid fill is used. Long life, freedom from breakage and permanency of operating angle are claimed.

For use in building heating the Link-Belt Co., Stoker Division, 2410 West 18th St., Chicago, Ill., has announced the Radiostat temperature control, a device employed in combination with its stoker systems. This instrument uses electronic tubes, is governed by outside temperature and operates on a change as small as 1 deg. It maintains building temperature by constantly varying the pressure or vacuum carried within the boiler and maintains an active stoker fire by operating on a differential of 1/3 lb. pressure. The system is said to produce an average saving of 15 per cent in steam through the elimination of overheating.

MANUFACTURERS' LATEST PUBLICATIONS

Acetylene. Air Reduction Sales Co., Lincoln Bldg., New York City—Booklet on acetylene versus various other fuel gases, with data on flame temperature, heating efficiency and heat values, together with comparative consumption of oxygen in metal cutting.

Activated Carbon. Darco Corp., 60 East 42d St., New York City—12-page booklet describing the use of this company's Darco G-60 activated carbon in conditioning wines.

Alloys. International Nickel Co., 67 Wall St., New York City—Bulletin C-5—20 pages completely descriptive of the use of Monel metal and nickel in gas works.

Cements. Atlas Mineral Products Co., Mertztown, Pa.—Reprint of an article by C. R. Payne, describing the use of this company's improved sulphur-base acid-proof cements for the protection of sewers against acid industrial waste and other acidic materials. Report describes types of construction and gives chemical and physical properties.

Chemicals. Atlas Powder Co., Wilmington, Del.—Folder briefly describing the new chemicals, Mannitol and Sorbitol, with information on physical and chemical properties and uses.

Chemicals. The Barrett Co., 40 Rector St., New York City—48 pages on Cumar resin, its uses, forms, chemical and physical properties.

Chemicals. Bloomfield Chemical Co., 169 Bloomfield Ave., Bloomfield, N. J.—4-page folder on this company's boiler treating compound, said to be suitable for all boiler feedwaters and all types of boilers.

Chemicals. Hercules Powder Co., Wilmington, Del.—30 page booklet, "Hercules Chemist," describing this company's products for coatings, including Tornesit, rosin, synthetic resins, and nitrocellulose emulsions.

Chemicals. Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia, Pa.—12-page booklet on aqua and anhydrous ammonia with reference to properties, handling, containers and first aid.

Drying. Hardinge Co., York, Pa.—AH-332—Leaflet briefly describing this company's system of simultaneous drying and grinding.

Drying. Hersey Mfg. Co., South Boston, Mass.—6-page booklet briefly describing this company's rotary dryers, the company's engineering facilities and products dried.

Electrical Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 1154A—28 pages covering construction and uses of this company's modern coupled and engine-type synchronous motors.

Electrical Equipment. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Leaflet 20652—2 pages briefly describing an improved totally inclosed design of explosion-proof, direct-current motor.

Equipment. Baldwin - Southwark Corp., Paschall P. O., Philadelphia, Pa.—"Baldwin-Southwark," Vol. 1, No. 1, first issue of a new publication offered by this company. This issue, on the occasion of the company's 100th anniversary, devotes its pages to the history of the founder, the company, the company's accomplishments, and the history of associated and affiliated companies.

Equipment. C. A. Norgren Co., Denver, Colo.—Catalog 200—24 pages on pneumatic products including lubricators, regulating valves, regulators and relief valves, strainers, air hose and fittings.

Equipment. Patterson Foundry & Machine Co., East Liverpool, Ohio—12-page discussion of processing kettles for resins, varnishes and other products, including steam, electric, direct-fired and oil-heated kettles.

Equipment. Sturtevant Mill Co., Harrison Square, Boston, Mass.—32-page miniature bulletin covering this company's products, containing reproductions of standard size bulletins on crushing and pulverizing equipment of several types, vibrating screens, mixers, elevators, and superphosphate machinery.

Expositions. Exhibitors Advisory Council, 330 West 42d St., New York City—Second annual edition of this company's listing of all industrial, trade, agricultural, professional, business and miscellaneous shows and expositions scheduled to be held in 1937. Non-member companies may secure copies at $5 each.

Floodlights. Crouse-Hinds Co., Syracuse, N. Y.—Extensive catalog of 14 sections covering all types of floodlights, their accessories, installation, suggestions and calculations, together with sections on vapor- and dust-proof and other types of lighting fixtures.

Heating Equipment. H. O. Swoboda, Inc., 4301 Main St., Pittsburgh, Pa.—Circulars 247, 248 and 258—Leaflets briefly describing electrical heating equipment including a portable electric heater for stress-relieving pipe welds and an electric muffle furnace.

Heaters. Griscom-Russell Co., 285 Madison Ave., New York City—Form 499—4 pages describing a storage-tank oil heater for heating viscous oil to be withdrawn from oil storage tanks.

Instruments. Adam Hilger, Ltd., 98 Kings Road, Camden Road, London, N.W.1, England—Publication 242—15 pages on this company's polarimeters, including a new standard design.

Instruments. Automatic Temperature Control Co., 34 East Logan St., Philadelphia, Pa.—Bulletin G-9—4 pages briefly discussing this company's controls for temperature, time, level, flow and pressure; also G-10, 4 pages illustrating and giving specifications of this company's motor-operated controllers.

Instruments. Brown Instrument Co., Philadelphia, Pa.—1936 edition of this company's Flow Meter Engineering Handbook, 164 pages, price $2. Book, which is neatly bound in stiff covers and printed on coated paper, is written for flow meter users and covers general flow meter engineering, orifice design, measurement of steam, water, liquids, air and gases, and gives numerous tables and other information.

Instruments. The Foxboro Co., Foxboro, Mass.—Bulletin 214—28 pages on air-operated control valves, dampers, switches, lever-motors, and accessories, supplied by this company. Also folder DMF699, briefly describes advantages of this company's potentiometer Stabilog.

Instruments. Precision Scientific Co., 1750 North Springfield Ave., Chicago, Ill.—Bulletin TS-3000—24 pages giving complete information on B.t.u. tests with this company's flow type gas calorimeter. Also Bulletin TS-3110, 8 pages on wet test laboratory gas meters.

Materials Handling. Gifford-Wood Co., Hudson, N. Y.—Catalog 136—111 pages on a wide variety of materials handling equipment for bulk and packaged materials, including elevators, conveyors, larries, drags, hoists, cars and accessories.

Metals and Alloys. New Jersey Zinc Co., 160 Front St., New York City—28-page booklet describing zinc metals and alloys, briefly discussing all of this company's metal products except rolled zinc. Gives data on physical properties, corrosion resistance, etc.

Power Transmission. Graham Transmissions, Springfield, Vt.—Bulletin 302—12-page catalog and price list completely describing construction and principle of this company's new variable-speed transmission.

Power Transmission. Reeves Pulley Co., Columbus, Ind.—32-page booklet, "Speed Control at Work," describing methods employed in 12 cases in securing speed adjustability of production machinery.

Power Transmission. Rockwood Mfg. Co., 1801 English Ave., Indianapolis, Ind.—Data Books 782 and 783—Respectively 32 and 12 pages covering multi-groove V-belt drives and single-groove drives for fractional horsepower, the total range being from fractional to 500 hp. Arranged for ready selection and price determination.

Power Transmission. Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa.—Data 25-030—8 pages with description and engineering data on this company's single and double reduction speed reducers.

Pumps. Roots-Connersville Blower Corp., Connersville, Ind.—Bulletin 260-B11B—4 pages describing this company's Type T turbine pumps, showing latest improvements, capacities and performance.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-313-B1—8 pages on this company's Mixflo centrifugal pumps for low-head service.

Refractories. Harbison - Walker Refractories Co., Farmers Bank Bldg., Pittsburgh, Pa.—Leaflet briefly describing four grades of firebrick offered by this company.

Safety. Ampco Metal, Inc., Milwaukee, Wis.—Catalog 114—20 pages on non-sparking safety tools in wide variety, produced in Ampco metal and beryllium-copper. Gives prices.

Screening. Productive Equipment Corp., 4600 South Kedzie Ave., Chicago, Ill.—32-page booklet of data on controlled vibration and screen efficiency with this company's vibrating screens.

Chemical Engineering NEWS

A. I. Ch. E. Acts on Stream Pollution and Patent Court

AT ITS annual meeting in Baltimore, November 11-13, the American Institute of Chemical Engineers definitely revived its interest in stream pollution and passed a resolution favoring the establishment of a single court of patent appeals to be served by at least three scientific advisors. A new committee on Trade Waste Disposal, headed by Dr. W. S. Landis, vice-president of the American Cyanamid Co. presented a program and a tentative resolution for criticism and discussion by the meeting.

In view of the fact that fourteen separate regulatory bills are under consideration at the present time, the committee resolution recommended: (1) that any regulatory program should be formulated by state and federal agencies in cooperation with the industries affected, (2) that no prohibitive regulation should be effective against an existing waste unless and until a practical method of disposal is available, (3) that intrastate cases should be under local control, (4) that wherever possible the regulatory program should be enforced by inter-state compacts rather than by federal legislation, (5) that the United States Public Health Service should be required to formulate a program for cases which cannot be settled by agreement between states and (6) that the Secretary of War should have authority over cases where wastes affect navigation, etc.

Discussion lead by J. J. Healy, Jr., of Monsanto and Professor G. G. Brown of Michigan, questioned the wisdom of opposing regulation even in cases where methods of treatment have not yet been developed. All agreed, however, that the control by local option should be encouraged. No official action was taken on the resolution.

George Ramsay, chairman of the U. S. Patent Office Advisory Committee, appeared before the Institute on November 13 at the invitation of Thomas Griswold, Jr., of the Dow Chemical Co., chairman of the A. I. Ch. E. Committee on Patents. Mr. Ramsay pointed out that the Council of the Institute in January, 1936, had voted in favor of a single court of patent appeals, and he cited a number of reasons why a change in the present system of adjudication is highly desirable. He then referred specifically to pending legislation, particularly to S. 3823, a Bill to establish a Court of Patent Appeals. One provision of this bill provides for the appointment of three scientific advisors to the court, these men to be appointed by the court for life tenure. Mr. Ramsay pointed out that there was some opposition to this provision on the basis that it was not necessary to keep highly paid men on retainers and that the same purpose could be attained by providing a list of available authorities who could be called in by the court.

Frank G. Breyer, president of the American Association of Consulting Chemists and Chemical Engineers, defended the provision for scientific advisors and pointed out that this concurred with a recommendation of the President's Advisory Committee on Science. Breyer regarded this provision as "an attempt on the part of technical men to get back some of the rights that the patent lawyers have taken away from us." Following discussion from the floor, the Institute went on record approving the action of the Council of January 10, 1936, and definitely favoring the provision for scientific advisors to the court.

Farm Chemurgic Conference At San Francisco

THE Farm Chemurgic Conference held in San Francisco on November 18, brought forth something of interest on the part of business men and chemists but very little from the farmer. The conference was sponsored by the California State Chamber of Commerce, its chairman, A. M. Paul, presiding. Carl B. Fritsche, managing director of the National Council, reviewed the work of his organization and gave an account of successful chemical industries in California which are dependent on agriculture for raw materials.

Dr. William J. Hale credited the Fordney—McCumber tariff act with the commercial development of our present chemical industry and brought forth the thesis that farm surpluses may be considered as byproducts which formerly were transformed into energy by farm animals. The hope of chemistry is in arresting the degradation of natural products at levels where the energy store can be used. He ranks alcohol for power of greatest importance, and for this he coined another word —"agrol." Dr. Hale prophesied houses made of cellulose acetate when the price of this plastic reaches 10c. per lb.

His statement that alcohol belongs in gasoline again opened that perennial argument between the petroleum economist and the chemurgist, this argument filling up most of the latter part of the session, obscuring discussion and reports by workers on other interesting problems.

Two addresses, one by W. C. Mullendore, executive vice president of the Southern California Edison Co., and the other by John Pickett, editor of the Pacific Rural Press, were inspiring and of interest. Mr. Mullendore discussed the farmer's problem, showing its history, pointing out that because the farmer supplies energy in the form of food, the industrial revolution created the farm problem by substituting nature's stored-up energy for a portion of the farmers products. Nine million horses and mules have disappeared and twenty seven million acres of land were required to furnish them with food. He suggested that the chemurgic movement broaden its outlook and not confine its major activities towards getting alcohol into gasoline.

New Corporation to Sell Titanium Pigments

THE Titanium Pigment Corp., a subsidiary of the National Lead Co., has been formed under the laws of New Jersey to succeed the Titanium Pigment Co., which has been dissolved. The newly formed corporation will act as selling agent for the Titanium products manufactured by the National Lead Co. Main offices will be retained at 111 Broadway, New York, with a branch office in St. Louis.

The officers of the new corporation are:—president, Ralph M. Roosevelt; vice-president, C. F. Garesche; secretary-treasurer, F. H. Dow; assistant secretary-treasurer, A. L. Hoffman; general sales manager, I. D. Hagar; eastern sales manager, G. W. Corddry; western sales manager, D. W. Edgerly.

Chemical Engineers Select Toronto for 1937 Meeting

EDITORIAL STAFF REPORT

TORONTO, Ontario, was selected for the May, 1937, convention of the American Institute of Chemical Engineers by vote of the members attending the 29th annual meeting at Baltimore, November 11-13. The invitation was presented by Col. L. E. Westman, editor of *Canadian Chemistry & Metallurgy* and was signed in addition by Prof. J. Watson Bain of the University of Toronto and Dr. A. E. R. Westman, director of the Ontario Research Foundation. Plans have been made for excursions to the diversified manufacturing industries of that important area.

The Baltimore meeting, with the largest attendance on record (358 members and guests and 170 student registrants), climaxed one of the most successful years in the Institute's history. F. J. LeMaistre, executive secretary, reported substantial increase in membership, the establishment of new local sections at Pittsburgh and in Western New York. Dr. H. A. Curtis, chairman of the Committee on Chemical Engineering Education, reported that during the past year the Institute had cooperated with the Engineers' Council for Professional Development in its major program of accrediting engineering institutions. Of 39 schools in the Eastern part of the United States which have been studied by E. C. P. D., chemical engineering has been accredited in 12. The addition of Pennsylvania State College, University of Pennsylvania and Drexel Institute, bring the A. I. Ch. E. total to 27 accredited institutions.

Professor J. C. Elgin of Princeton reported that the Institute now has student chapters in 45 schools and colleges and these chapters have a total membership of 3300. His committee, in cooperation with the local committee on arrangements headed by Prof. F. C. Vilbrandt of Virginia Polytechnic Institute, held a highly successful student meeting in Baltimore, November 9 and 10. Representatives from 21 student chapters were in attendance; V. P. I. leading with 32, Pennsylvania second with 29, Carnegie third with 23, followed by North Carolina with 14 and University of Pittsburgh with 13. Six student members came all the way from the University of Detroit. The two-day program consisted of a series of inspection trips to large industrial plants in the Baltimore area and a symposium on "Technical Sales as a Field for Chemical Engineering Graduates." Speakers included Dr. Martin H. Ittner, chief chemist of Colgate-Palmolive-Peet and president of the Institute, Frank J. Curtis of the development department of Monsanto Chemical Co., St. Louis, Sidney D. Kirkpatrick, of *Chem. & Met.*, and Lauren B. Hitchcock of Hooker Electrochemical Co. of Niagara Falls.

At the opening business session on November 11, F. C. Hettinger, superintendent of the U. S. Industrial Chemical Co. and chairman of the committee of tellers, announced the re-election of Dr. Martin H. Ittner, Jersey City, president; Fred C. Zeisberg, Wilmington vice-president; Frederic J. LeMaistre, Philadelphia, secretary, Carl R. DeLong, New York, treasurer. Five new directors were also elected: Lawrence W. Bass, New York; Thomas H. Chilton, Wilmington, Del.; Gaston F. DuBois, St. Louis; Sidney D. Kirkpatrick, New York; and Walter G. Whitman, Cambridge, Mass.

Radium Companies In Merger

THE Radium Chemical Co., Radium Preparations, Inc., the Radium Luminous Corp., and the Radon Co., all of New York, have been consolidated in a newly organized corporation, the Radium Chemical Co. Papers filed at Albany give the capital of the new corporation as 3,000 shares of no-par-value stock.

Almost two hundred members and guests of the American Institute of Chemical Engineers visited Curtis Bay plants of U. S. Industrial Alcohol Co. during the recent meeting in Baltimore.

NEWS FROM WASHINGTON

Washington News Bureau
McGraw-Hill Publishing Co.
Paul Wooton, Chief

INTERPRETING the election has been Washington's favorite indoor sport of November. A close second in popularity has been the guessing game, "Will the President swing right or left?" A poor third in the political sports list is trying to pre-guess Congressional activity.

All of this has important significance for process industry. But a very few simple principles provide all the necessary rules of the games for industrial executives. Perhaps only one rule will suffice for all of the *useful* forecasting. In brief it says: Every administrative decision and all legislative plans will be measured first by the yardstick of social consequence. Economic consequences may be taken into account; but they rarely will be if they indicate a variation from the desired social course of action.

Legislation

Many proposals to be placed in the legislative hopper the first week of January will be far more drastic than anyone expects in the final enactments. The game of political barter makes it necessary to ask more than you expect, perhaps more than you want. You thus establish a trading area and get more nearly the intended legislative result. Serious attention must be given to all such bills, but industrial panic is altogether unwarranted. Neither the radical nature nor the amount of commotion created are measures of prospective actions of Congress.

Pressure groups are always an important factor in determining the general course of legislation. However, they may have a little less influence in the coming Congress than usual. The unprecedented majorities in both Houses may prevent any bloc, even one formerly powerful, from retaining its veto power over legislation. Both conservative and sincere progressive groups hope so.

Food and Drug Law

Resignation of Rex Tugwell and heavy loss of political influence by Senator Copeland does not mean that the drive to revise the food and drug law is without leaders. Rep. Rayburn, of Texas, and Rep. Chapman, of Kentucky, still are in Congress. Mr. Rayburn is likely to be the majority leader. They undoubtedly will continue their active interest in this matter.

Instead of trying to bring out an entirely new bill at this session the plan now is to attempt to secure the objectives sought by amending the existing law.

Representatives Rayburn and Chapman are certain to continue to insist on advertising control by the Food and Drug Administration. The fact that they were voted down before 190 to 70, is not significant as many members were not on the floor when that vote was taken.

At the same time the Federal Trade Commission has many friends on Capitol Hill. It is not going to be easy to defeat its ambitions.

Railroad Transportation Rates

Manufacturing Chemists' Association has joined forces with the other 250 odd protestants which have filed replies to the petition of the Class I carriers to the Interstate Commerce Commission. The railroads ask the commission to modify the outstanding orders in more than one thousand cases so the roads may file tariffs carrying increases of maximum rates prescribed by the commission in such cases.

The petition of the roads also asks the commission to grant fourth section relief required to carry out the increased rates if allowed.

The outstanding orders of the commission issued since 1920 are effective until further orders of the regulating body unless that authority should modify such orders. So long as they remain in force carriers may not publish higher rates, so what they are doing is to request the commission to set aside the bar.

Taking advantage of the commission's announcement that any replies would have to be filed prior to Nov. 7, the Manufacturing Chemists at their annual meeting in New York authorized the filing of such a reply, which has been prepared by Harry C. Ames, counsel for the association.

In this reply the chemists ask the commission to automatically suspend and investigate any tariff which carries increase in rates, and in the event such a tariff is granted, the roads should be made to a showing, based on conditions affecting the particular commodity involved in the proposed change, and to prove that the increase suggested is justified.

Walsh-Healey Act

Recent rulings by Madam Perkins on the administration of the Walsh-Healey Act, are of direct interest to the chemical industry. First of these pronouncements dealt with agency contracts, and provides that where a dealer, instead of filling a government contract from his own shelves, quotes manufacturer's price and has the factory ship the goods directly to the government, such dealer is to be held as an agent acting for an undisclosed principal.

The rule adds that the manufacturer in such cases will be considered a party to the contract and as such, responsible for conforming to labor stipulations of the act.

This rule, as is evident, restricts the dealer provision in the regulations considerably.

The second ruling of interest to manufacturing chemists, deals with petroleum and petroleum products. The ruling provides that in contracts for delivery of crude oil, where contractor is a producer, the law covers employees who extract the oil or prepare it for shipment.

In contracts for petroleum derivatives, where the contractor is also a refiner, the law applies to employees who are engaged in manufacturing and in the preparation of the product for shipment. Where the contractor is a dealer the law applies to employees at terminals, warehouses, and storage tanks and includes warehouse compounders and chemists testing the lot as well as the crews loading materials in vessels, tank cars or tank wagons.

Fertilizer manufacturers have asked the Federal Trade Commission for an open pricing rule, asserting that "full knowledge" of current prices is required for complete compliance with the Robinson-Patman Act.

FTC officials are confident that the fertilizer industry is determined to comply with the provisions of the act so far as it can be interpreted at present, and to avoid all violations of any of the laws providing for fair trade practices.

The trade leaders have expressed their belief that improved business conditions are certain to result from such a position.

Spanish Minerals

Washington expects that ultimate settlement of the Spanish rebellion will find Fascisti in power. This means close alliance with Italy, possibly even an economic dominance in Spanish affairs through unofficial channels.

Numerous commodities important in the mineral trades may be effected. Quicksilver production, and the world market price, would continue on such high levels as have prevailed in the past to permit Italian output. New reserves of lead, and to a lesser extent zinc, will strengthen Il Duce's preparedness base. Spanish iron ore and pyrites, and indirectly sulphur, will be very welcome in the Mediterranean area. Transfer of commercial allegiance would be a serious setback for British iron and steel, some Washingtonians believe.

Emphasis on these important strategic materials vital to the "preparedness" process industries of all Europe is essential. Activity in Germany with a similar objective stresses the need for self-sufficiency in food, fuel, and certain mineral raw material. An elaborate report on this problem, giving a quantitative appraisal of progress being made, is shortly to be released from the Bureau of Mines. This report by Consul Will Wright of Berlin illustrates the important advantage to American industry of having a well informed technical man investigating foreign situations. The factual appraisal of this report is particularly welcome amid the confusing claims and counter-claims of political writers and even "career" officials.

International Cartel activities last month came in for most unusual commendation in Washington. The wide swings in the price of tin during the two weeks when it appeared that Siam would not continue in the Cartel were many times greater than any fluctuations during the three year life of the expiring agreement. As one official says, "Such fluctuations in price are more serious for consumer industry than is the rising price which results from world control." Perhaps one should add to this the qualification "if the Cartel is not unduly greedy."

New Regulations

Administration of the many new types of law enacted by the last Congress is now well under way. As a result every business man has a flock of new sets of rules to watch. Several of these deserve note even by technical executives:

1. Sales of goods to the Government usually come under the Walsh-Healey Act. The first relatively simple rules regarding labor seemed to offer many loopholes but supplemental regulations promptly close each such gateway by revisions as industry attempts escape. Perhaps most important is new Article 104, which declares that a dealer must commit the manufacturer - principal when the goods go directly from the manufacturer to the Government. This alone is not important as transshipment would be simple; but it signifies clearly that the Department of Labor will press more and more complications so long as evasions are attempted.

2. Social Security rules will be enforced regardless of the complexity and seeming impossibility of compliance. Some simplifications will be asked of Congress to reduce the number of individual transactions; but essentially the administration will be along the lines of the original bill, even if it takes most of the present unemployed to enforce the act.

3. Tax collections will proceed along the lines of the 1936 law. Washington does not expect any important modifications with respect to distributions of earnings, except for a few classes of distressed small companies which may be allowed to hold earnings for brief periods while escaping from financial embarrassment. Washington does not expect the President to ask for new taxes nor any important changes in present tax rates. Continuance of certain "temporary" taxes that expire next June seems inevitable because "we need the money for the Treasury."

4. Labor is asking for a definite segregation of Social Security tax funds to avoid Congressional extravagance and diversion. Some concession in this direction may be given; but labor will *not* be granted its second request, that all such taxes be placed on the employer, none on the employee—at least not in 1937.

Chemical Alliance Elects Officers and Directors

At its annual meeting held in New York on Nov. 2. The Chemical Alliance, Inc., elected a long list of directors representative of leading chemical companies of the country. On Nov. 17, the Board of Directors met and elected officers for the ensuing year as follows: president, W. B. Bell, American Cyanamid Co.; vice-presidents, Lammot du Pont, E. I. du Pont de Nemours & Co., Inc.; Chas. Belknap, Monsanto Chemical Co.; and Willard H. Dow, The Dow Chemical Co.; treasurer, J. W. McLaughlin, Carbide & Carbon Chemicals Corp.; secretary, W. N. Watson.

The Executive Committee consists of the above named officers together with E. M. Allen, Mathieson Alkali Works; Horace Bowker, American Agricultural Chemical Co.; Glenn Haskell, U. S. Industrial Alcohol Co.; Geo. W. Merck, Merck & Co., Inc.; August Merz, The Calco Chemical Co., Inc.; and A. E. Pitcher, E. I. du Pont de Nemours & Co., Inc.

Dow Files Statement For Sale of Debentures

THE Dow Chemical Co., Midland, Michigan, has filed a registration statement under the Securities Act of 1933 covering $5,000,000 of fifteen year 3¼ per cent debentures, due December 1, 1951.

The company states that no allocation has been made of the proceeds to be received from the sale of the debentures, but it is expected that they will be used to supply funds for, or to replenish working capital previously applied to, capital additions, replacements and improvements to plants, processes and facilities, and the purchase of stock of the Cliffs Dow Chemical Co., a subsidiary.

According to the statement, the more important of such projects completed during the past year or at present under construction together with the respective amounts expended or to be expended, are approximately as follows: Construction and equipment of ethylene products plants, $800,000; construction and equipment of a chlorine plant, $800,000; additions to power plant, $500,000; construction and equipment of a carbon tetrachloride plant, $300,000; construction and equipment of additional laboratory building, $300,000; purchase of real estate at Bay City and the equipment of a Dow metal foundry building, $175,000; construction and equipment of a carbon bisulphide plant, $100,000; and the purchase of preferred stock of the Cliffs Dow Chemical Co., $600,000.

Chemical Consumption In Canadian Textiles

TOTAL cost of materials used in the finishing and dyeing of textiles in Canada increased from $1,504,033 in 1934 to $1,560,868 in 1935, according to data collected by the Dominion Bureau of Statistics. The volume of consumption of certain of the principal materials used by the industry in the two years compares as follows:

	1935 lb.	1934 lb.
Acetic acid	85,573	71,347
Alum	76,210	80,384
Aqua ammonia	59,020	65,786
Bleaching powder	27,336	17,004
Carbon tetrachloride	7,538	8,675
Chlorine, liquid	140,819	150,104
Dyes—		
Acid or basic	67,020	126,700
Direct	56,090	53,024
Indirect	12,571	12,786
Sulphur	67,127	117,175
Other	146,675	35,734
Formic acid	95,590	49,914
Glauber's salt	702,829	605,690
Hydrogen peroxide	70,122	61,279
Muriatic acid	304,693	346,757
Soda ash	419,909	497,328
Sulphonated oils	23,789	16,203
Sulphuric acid, 66°	277,320	213,488
Tin tetrachloride	468,140	459,414
Trisodium phosphate	17,286	14,034

Cellulose Production in Germany on Increasing Scale

FROM OUR GERMAN CORRESPONDENT

WITH increasing cellulose production in Germany, new cellulose factories are being built. By February 1937, I. G. Farben's new plant should be in operation. It is planned to use two processes with beech wood as raw material. The daily capacity of the sulphite process division is planned at 100 metric tons daily, while the nitric acid process division making a special high grade cellulose will produce 25 tons daily.

Negotiations are underway to build a privately financed staple fiber factory in Siegburg, which should commence operations by July 1, 1937.

After being shut down for several years the fiber plant Glauchau A.G. has resumed operations and is extending its plant capacity to treble the present fiber production.

On October 26 the new high pressure power plant of the Leverkusen I. G. works began operations. The new unit costing 5 million RM, is unique in that it has no smokestacks and embodies some entirely new technical features.

Hamburg and Altona are planning a joint municipal clarifying plant in which the sewage gases will be cleaned and sold commercially as motor fuel and the remaining sludge as commercial fertilizer.

In 1935 Germany imported 394,000 metric tons of manganese ores compared with 225,000 tons in 1934, 58 per cent of which came from Russia, the remainder from British India, West and South Africa, Turkey, etc. From January to August 1936 manganese imports declined from 258,000 to 129,000 tons compared with last year. The South African Union has become the chief supplier and Russia has dropped to third place.

Because of foreign currency and raw material shortages some of Germany's heavy industries are cutting steel production by 10 per cent in November and by 20 per cent in December.

Germany's chemical exports will undoubtedly be influenced by the recent currency devaluations of some of her best customers. One third of Germany's total foreign trade goes to the six countries (including colonies), France, Netherlands, Italy, Czechoslovakia, Belgium and Switzerland. In the past, 22 per cent of Germany's chemical production has gone to these countries. Although developments will vary according to products, in general, Germany will have a hard time holding her own in these countries because she cannot raise prices to correspond to the devaluations, and in third markets to which these same countries export many chemical products, their devaluated currencies will allow them to underbid German exporters. Already difficulties have manifested themselves in clearing and in interpreting the payment clauses of contracts with firms in the depreciated gold bloc countries.

Wages in chemical industry

In keeping with the general government wage policy, during the past year wages in the German chemical industry have shown little change. The middle of this year for an average 45½ hour working week the skilled male worker received a gross weekly wage of 47.49 RM ($20), the unskilled male worker 39.66 RM, and the female worker 22.61 RM. The deductions from wages for wage taxes, compulsory unemployment and disability insurance, etc. averaged about 12.4 per cent of the gross wage for all workers in the chemical industry.

The long-planned project of bringing the surplus gas of the Ruhr coking plants to the large industries of southern Germany is materializing with the beginning of the construction of long-distance pipe lines from Siegen to Frankfurt by the Ruhrgas A.G. The extension of the overland gas network has largely been made possible through contracts, especially with I.G. and the Opel motor plants, to supply the following large industries: Stahlwerk Röchling-Bruderus A.G. in Wetzlar, Vereinigte Deutsche Metallwerke und Kupferwerke in Heddenheim, Alfred Tewes G.m.b.H. and Braun & Tewes in Frankfurt, Deutsche Gold- und Silberscheideanstalt (formerly Roessler) in Frankfurt, I.G. Farbenindustrie A.G., Maingauwerke, Adlerwerke in Frankfurt, and Opelwerke A.G. in Rüsselheim.

Another effort to stimulate the use of coal as fuel for new streamline trains is to be seen in the lucrative prizes offered by the Rhenish-Westphalian Kohlensyndikat for the best plan submitted for a light streamline steam-engined train fired with high quality coal. In Germany there are now 502 streamlined cars carrying their own source of power. Of these 302 are powered with combustion engines, 184 with electric generators and 16 with steam engines. The large percentage of combustion motors is due to the high development of Diesel engines in Germany.

Jojoba Shrub Yields Oil Like Sperm Oil

A VEGETABLE oil similar to the sperm oil of the whale, has been discovered by the Bureau of Chemistry and Soils. This oil comes from the seed of a shrub, called Simmondsia Californica, but better known in lower California, Arizona and northern Mexico, as the wild hazelnut, sheep nut, or goat nut. The oil is really a liquid wax, composed of unsaturated acids and alcohols combined into esters.

The Mexicans call the plant jojoba. The nut is not rare. For centuries it has been relished by the Indian tribes inhabiting the area and the oil has been used commercially as a hair tonic.

Twenty-five pounds of nuts were gathered in Sonora, Mexico, and shipped to a commercial feed firm in St. Louis. Then they were sent to the Bureau of Chemistry where the oil was extracted. It was found that they yielded 51.2 per cent of a light yellow oil.

Testing of this oil by Drs. G. S. Jamieson and R. S. McKinney started in the usual way. First they treated it with a strong alkali solution as in soap making. Vegetable oils under this treatment yield a soap and glycerine, but jojoba oil, yielded only about 50 per cent of soap and about 50 per cent of a yellow oil.

Mechanical Engineers Hold Annual Meeting

IN ADDITION TO the Power Show the 57th annual meeting of the American Society of Mechanical Engineers was held in New York during the week of Nov. 30. From a program of approximately 90 papers and round table discussions, chemical engineers and mechanical engineers of process bent found much to hold their interest. The announcement of the "Steamotive," which has been described as a "packaged power plant," has been discussed elsewhere in this issue and is perhaps the most significant development of the meeting. The Process Industries Division presented three papers on heat transfer and one each on drying of staple rayon fiber and paper. Sugar engineers listened to papers on crystallization and char filtration and discussed the latest developments in centrifugals. Of the eight papers on corrosion-resisting materials of construction, nearly all had a definite chemical industry slant.

Germany Plans Recovery Of Drain Pipe Greases

LARGE scale recovery of grease from drain pipes for use in the manufacture of soap and for other industrial purposes is being seriously considered in Germany as a part of its new four-year plan, according to reports from the American Consulate, Frankfort-on-Main.

The shortage of fats and oils in Germany is among the most acute of its national problems, the report states. The use of drying oils for paints and varnishes, fats and greases for soaps, edible fats for margarine, and lubricating oils for the rapidly growing number of automobiles, have all been placed under official control boards and subjected to strict regulations.

It is estimated that large quantities of grease are allowed to flow into sewers in Germany, a considerable part of which can be recovered for industrial uses. The fat and grease content is particularly high in waste water from restaurants and hotels, slaughter houses, and in butcher and sausage making shops. A German specialist estimates the annual loss through these channels to be in the neighborhood of 80,000 metric tons and that of this amount some 25,000 to 30,000 tons can be recovered for industrial uses.

Paint Production Clubs Meet in Chicago

AT the Fifteenth Annual Convention of the Federation of Paint and Varnish Production Clubs, held at the Drake Hotel, Chicago, November 15-17, committee reports, results of the research work established at the University of Michigan, and a symposium taking in various problems in paint and varnish production, furnished the main topics of discussion.

At the business session, officers for the ensuing year were elected as follows: president, Verne C. Bidlack, McCloskey Varnish Co.; vice-president, E. V. Ladd, Densol Paint Co.; secretary, George B. Heckel; treasurer, Clarence W. Clark, E. I. du Pont de Nemours & Co., Inc.

Galvanizers Form New Organization

A NEW permanent organization, "The Galvanizers Committee," definitely allying technical groups in the steel and zinc industries, is the result of a meeting held in Pittsburgh in the latter part of November at which representatives of over twenty companies were present.

This two-day meeting, which had its origin among sheet galvanizers who attended the technical sessions of the American Zinc Institute at St. Louis last April, was attended by executives, technicians and operating men from the galvanizing departments of sheet steel producers. Problems in sheet production occupied the early sessions; the final session was given over to a discussion of ways and means of continuing the meetings under a permanent arrangement.

The close relationship of the galvanizing departments to the zinc industry led to the adoption of a plan whereby the Zinc Institute assumes the sponsorship of the new organization, the president and secretary of the Institute to be ex-officio members.

CALENDAR

AMERICAN CHEMICAL SOCIETY, third chemical engineering symposium, division of industrial and engineering chemistry. Columbia University, New York City, December 28 and 29.

INTERNATIONAL BUREAU FOR TECHNICAL EDUCATION, Rome, Italy, December 28-30.

TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY, annual meeting, Waldorf-Astoria Hotel, New York City, February 22-25, 1937.

AMERICAN CHEMICAL SOCIETY, semi-annual meeting, Chapel Hill, N. C., April 12-15, 1937.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, Toronto, Canada, May, 1937.

Naphthalene Production Sharply Increased

RECENT information obtained by the Tariff Commission in the course of preparing a forthcoming survey of tariff information on synthetic resins and their raw materials indicates that the German export embargo on naphthalene and the increased demand in domestic markets has resulted in much higher prices and greatly increased production in 1936, with prospects for much greater expansion in 1937.

Naphthalene, obtained in the distillation of coal tar, also has been recovered in recent years in certain petroleum refining operations. It is used principally in the manufacture of certain synthetic resins, important in the production of a series of new finishes, similar to present automobile and refrigerator finishes.

Until recently our rapidly increasing consumption of naphthalene has been largely supplied by imports, which enter free of duty, principally from Germany. Imports in the last three years have averaged nearly 50 million pounds annually. Late in 1935, however, Germany in order to lessen her dependence on imported paint materials, placed an embargo on exports of naphthalene. As a result of this action in conjunction with a greatly increased demand in the United States, the domestic price, which has been 1½ to 2 cents a pound, has increased to between 2½ and 4 cents a pound.

Imports from the United Kingdom increased sharply in the first eight months of 1936, and appreciable quantities from Czechoslovakia and the Union of Soviet Socialist Republics, hitherto relatively unimportant sources, have somewhat relieved the shortage.

The United States is the largest potential producer of naphthalene, but in coal-tar distillation it is produced in conjunction with creosote oil and pitch, for which the demand is limited. At the prices formerly prevailing, it was not profitable to produce naphthalene in the quantities in which it was consumed here. At present prices, however, production has been stepped up considerably, and in 1936 it probably will amount to 70 million pounds in comparison with about 50 million pounds in 1935. With new capacity being installed, 1937 production may reach or even exceed 100 million pounds, the exact amount being determined largely by the trend in price.

Domestic production, imports, and consumption since 1926 have been as follows.

Production and Imports of Crude Naphthalene

Year	Domestic production 1,000 lb.	Imports 1,000 lb.	Apparent consumption 1,000 lb.	Per cent consumption supplied by imports
1927	53,325	6,577	59,902	11
1929	39,263	35,007	74,270	47
1931	20,934	30,971	51,905	60
1933	30,621	42,786	73,407	58
1934	37,922	47,995	85,917	56
1935	47,653	48,455	96,108	50
1936[1]	70,000	35,000	105,000	33

[1] Estimated.

PERSONALITIES

Julian M. Avery

JULIAN M. AVERY, electrochemical and metallurgical engineer formerly with Union Carbide and Carbon Corp., has joined the staff of Arthur D. Little, Inc., research chemists and engineers of Cambridge, Mass. He will be engaged in research and development work.

L. S. KASSEL has joined the Universal Oil Products Co. staff as a research engineer. Since 1931 he has been with the U. S. Bureau of Mines as physical chemist.

ROBERT I. WISHNICK, chemical engineer and president of Wishnick-Tumpeer, Inc., chemical manufacturers, has been elected to the board of trustees of Armour Institute of Technology, Chicago.

W. G. MACNAUGHTON has resigned from the Experimental Pulp and Paper Laboratory, Savannah, Ga., to return to the News Print Service Bureau in the capacity of engineer, which position he held during 1928 and 1929. Mr. MacNaughton was one of the founders and the first vice-president of the Technical Association of the Pulp and Paper industry in 1915.

D. L. MATHIAS has joined the Metal & Thermit Corp., New York City, as research engineer in charge of electrode research and development.

RUSSELL P. HEUER, director of research for the General Refractories Co., has been elevated to the position of vice-president in charge of research.

F. E. CONDO, Ph.D., University of Illinois, 1936; R. H. TREADWAY, Ph.D., Indiana University, 1936; H. R. WILSON, chemical engineering research fellow, University of Michigan; have joined the staff of the experimental laboratory of the Grasselli Chemical Co. at Cleveland.

HARRY E. JORDAN, formerly chemical engineer of the Indianapolis Water Co., has been elected secretary of the American Water Works Association, with headquarters in New York City. His new duties include the editing of the *Journal of the American Water Works Association*. CECIL K. CALVERT, formerly superintendent of the Indianapolis Sewage Disposal Plant, now fills the position vacated by Mr. Jordan.

D. B. LANDES of the technical department of A. M. Byers Co. has been appointed manager of the engineering service department of that organization.

J. O. CLUTTON and E. ADAMEC, recent graduates of the chemical engineering departments of Purdue University and Armour Institute of Technology respectively, and V. BROWER, formerly chemical engineer with the American Crystal Sugar Co., are now employed by Corn Products Refining Co. at Argo, Ill.

Theodore Brentano Wagner

OBITUARY

THEODORE B. WAGNER, consulting chemical engineer and past president of the American Institute of Chemical Engineers, died Nov. 14 at his home in Brooklyn, N. Y. Prior to the establishment of his consulting practice in New York City, he was affiliated with the Corn Products Refining Co., where he will be remembered for his work in the development of new industrial uses for grain products. He is a past chairman of the American Chemical Society, and for eight years was president of the New York Chemists Club.

WILLIAM S. ROWLAND, president of the Stanley Chemical Co. of East Berlin, Conn., was stricken by a heart attack on Nov. 13. In 1909, Mr. Rowland left the employ of Arthur D. Little, Inc., to become chemical engineer for the Stanley Works, where he developed valuable processes in lacquer making. This work led to the establishment of a manufacturing subsidiary, the present Stanley Chemical Co.

AUGUSTUS H. GILL, professor emeritus of chemistry at Massachusetts Institute of Technology, died Nov. 11 at the age of 72 years. Dr. Gill had won prominence through his contributions in the field of analytical chemistry.

LEE B. METTLER, combustion engineer and manufacturer of gas burners, died at his home in Los Angeles, Calif., on Nov. 15. Mr. Mettler has been associated with the gas industry for many years.

ROBERT J. MUNN, director of research for the Lilly Varnish Co., Indianapolis, Ind., died Nov. 18 at the age of 76 years. Mr. Munn has been intimately associated with the varnish industry since 1891.

SAMUEL E. BOOKER, vice-president and general manager of the Peaslee-Gaulbert Paint & Varnish Co., Inc., Louisville, Ky., died of a heart attack on Nov. 11.

Chemical ECONOMICS

INDUSTRIAL production increased by the normal seasonal amount during October and continued to gain during the early weeks of November, according to a report of the Federal Reserve System.

The Board's index, adjusted to allow for seasonal movements, remained at 109 per cent of the 1923-25 average, thus maintaining the high level it had reached in September. The index is at a six year high.

A wholesale commodity price rise, one of the first in several months, took place between the middle of October and the middle of November, the Board noted. It also reported increased employment, payrolls, department store and mail order sales, freight car loadings, bank reserves and demand deposits. Construction contract awards declined despite a gain in private non-residential construction while variety store sales gained by less than the normal amount.

Summarizing industrial production in October, the board said: "Steel production was in larger volume than in any other month since 1929, and the rate of activity was sustained in the first three weeks of November. Output of automobiles increased sharply from September to October and in the first three weeks of November production increased further and was larger than last year. Activity at textile mills, which usually increases in October, declined slightly from the high level of September."

Marked gains in total net sales and a higher rate of collections on accounts receivable in October 1936 as compared with October a year ago were reported by manufacturers in the monthly joint study of the National Association of Credit Men and the Bureau of Foreign and Domestic Commerce.

Total nets sales of 542 manufacturers throughout the country registered an increase of over 17 per cent in October 1936 from October 1935. Without adjustment for seasonal influences, October 1936 sales registered an increase of over 4 per cent from September of this year.

Total sales increased in October 1936 over the same month last year for all of 15 industry groups shown in the report excepting food and kindred products. The increases ranged from 4.3 per cent for chemicals and allied products to over 38 per cent for iron and steel and their products. Increases in October 1936 sales over October 1935 for stone, clay, and glass products, and machinery also were high, each exceeding 30 per cent.

The degree of change in dollar volume of sales for some of the industries enumerated was as follows, the comparisons being with October 1935 and September 1936 respectively: paper and allied products, gains of 16.8 per cent and 5.6 per cent; paints and varnishes, gain of 3.8 per cent and decline of 5 per cent; pharmaceuticals, gains of 6.1 per cent and 39 per cent; petroleum products, gains of 15.2 per cent and 7.4 per cent; rubber products, gains of 14.8 per cent and 1.5 per cent; leather and its products, gain of 4 per cent and decline of 16.1 per cent; stone, clay, and glass products, gains of 35.5 per cent and 10.3 per cent; chemicals and allied products, gains of 4.3 per cent and 10.9 per cent; textiles, gains of 13.7 per cent and 3.4 per cent.

An unexpectedly large total for consumption of crude rubber was shown in the report for October, the figure being 49,509 tons according to the Rubber Manufacturers' Association. For the ten months ended October 31, domestic consumption was 473,593 tons compared with 406,760 tons for the like period of last year. Consumption for the entire year of 1936 promises to approximate 570,000 tons which would establish a record and would compare with a consumption of 491,544 tons in 1935. World consumption of crude rubber this year also is expected to set a new record with a total somewhat above 1,000,000 tons.

Plate glass production in October was higher than in any preceding month in the history of the industry, reaching a total of 20,752,657 sq.ft. The output of glass containers also has been running about 15 per cent higher this year than it did in 1935. It is probable that the glass industry as a whole is operating about 17 per cent higher than it did in 1935, although labor troubles in November closed some of the glass plants.

Deliveries of domestic potash to the United States and possessions in the third quarter of this year amounted to 93,327 tons of actual K_2O contained in 170,456 tons of salts. This comprised 133,461 tons of muriate, 18,281 tons of sulphate, 9,843 tons manure salts, 7,268 tons kainit, and 1,603 tons sulphate of potash-magnesia. Total deliveries for the first nine months of this year were 412,385 tons, equivalent to 212,532 tons of K_2O.

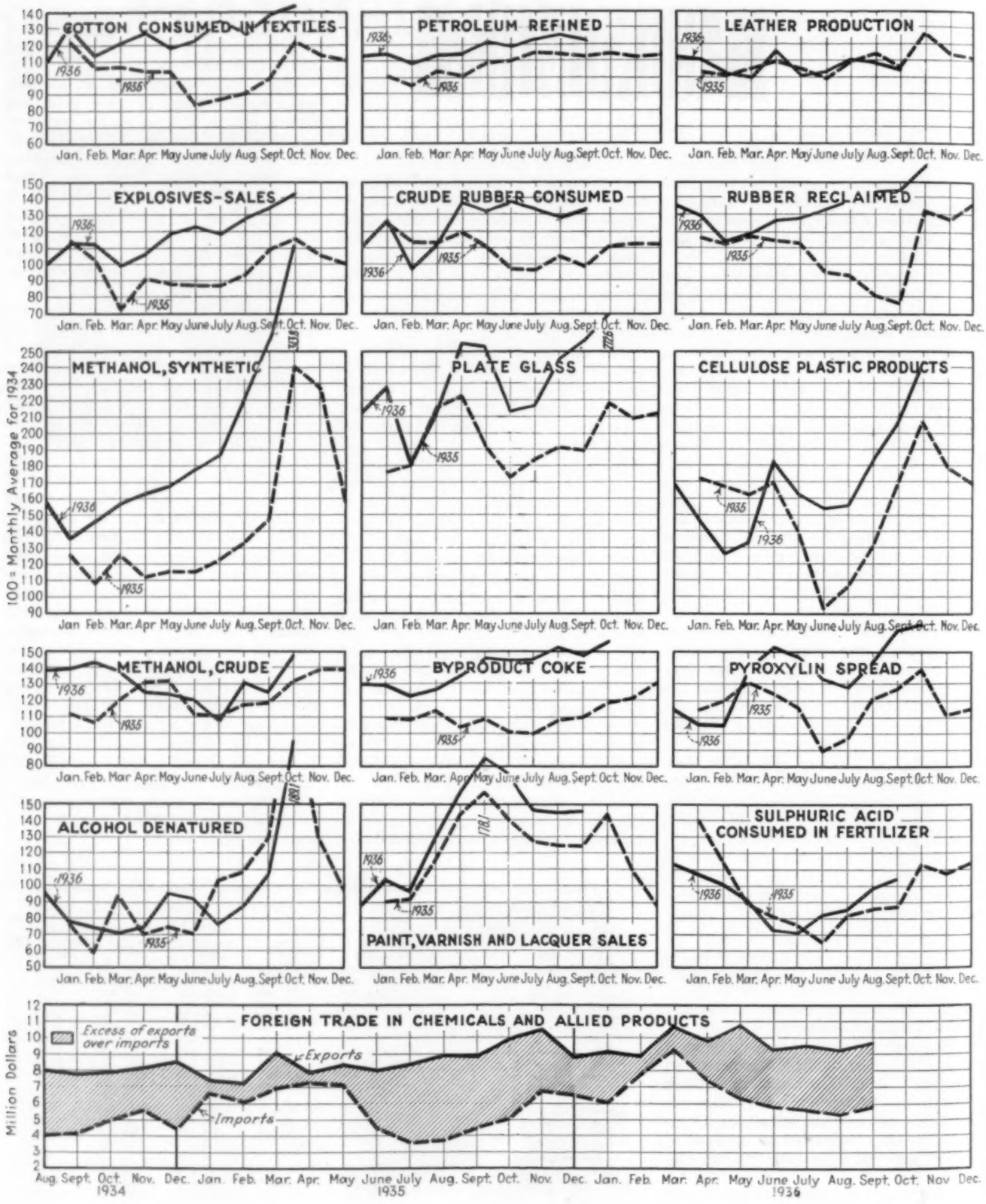
The Department of Commerce in its forecast for the cotton crop, pointed out that prospects were favorable for an increased use of insecticides and fungicides. This is based on the fact that favorable weather conditions prevailed this fall for maturing and picking the crop with the result that total yield was larger than had been anticipated and thereby placed growers in a better financial position for next season's requirements. In addition, reports from different agricultural sections showed that there has been a trend toward larger consumption of such materials as calcium arsenate, nicotine sulphate, and lead arsenate.

Production and Consumption Data for Chemical Consuming Industries

	Oct. 1936	Oct. 1935	Jan.-Oct. 1936	Jan.-Oct. 1935	Gain Jan.-Oct. 1936 over Jan.-Oct. 1935 Per cent
Production					
Alcohol denatured, 1000 wi. gal	15,034	17,160	75,239	79,258	5.3*
Ammonia, tons †	65,082	47,930	575,213	429,803	33.9
Automobiles, No	224,628	272,043	3,560,924	3,147,347	13.1
Benzol, 1000 gal	9,674	7,303	86,665	63,299	36.8
Byproduct coke, 1000 tons	4,071	3,052	36,108	27,789	29.9
Cellulose acetate plastics, 1000 lb	1,682	1,299	10,563	8,291	27.4
Nitrocellulose plastics, 1000 lb	1,806	1,660	13,943	13,438	3.8
Glass containers, 1000 gr	4,250	3,616	37,303	32,425	15.0
Plate glass, 1000 sq. ft	20,753	16,593	177,614	147,795	20.2
Methanol, crude, gal	511,541	454,233	4,494,693	4,091,915	9.8
Methanol, synthetic, gal	3,278,052	2,508,978	20,136,035	14,018,660	43.6
Pyroxylin spread, 1000 lb	6,081	5,125	51,194	43,517	17.6
Rosin, wood, bbl	57,809	43,719	545,763	459,054	18.9
Turpentine, wood, bbl	8,731	6,910	86,370	69,961	23.5
Rubber reclaimed, tons	14,737	11,926	120,321	94,685	26.8
Consumption					
Cotton, 1000 bales	646	553	5,774	4,636	24.5
Silk, bales	43,093	48,167	372,612	424,572	12.2*
Explosives, sales, 1000 lb	36,472	29,498	305,853	245,348	24.7

* Per cent of decline.
† Sulphate equivalent of byproduct coke plant production.

TRENDS OF PRODUCTION AND CONSUMPTION



The MARKETS

CHIEF interest in the market for chemicals in recent weeks has centered around the trend of prices. Conditions in general have pointed to a somewhat higher level for 1937 deliveries than was the case in the present year. Chemical prices, however, did not decline during the depression years to the same extent as did those for general industry and it is probable that any rise in chemical values in the near future will be of lesser degree than will be experienced in the case of all commodities. Such a result is borne out by the fact that many important chemicals already have been sold freely on 1937 contracts at the prices which prevailed for present year deliveries.

With wage increases fairly general and higher costs for some raw materials, the market as a whole undoubtedly is on a firmer basis than it was a year ago. In addition many selections will enter the new year at advances over the opening figures of last year. Among these may be mentioned nitrate of soda, sulphate of ammonia, animal ammoniates, copper sulphate, lead and zinc pigments with the exception of lithopone, bichromates, sodium phosphates, casein, benzol, cresylic acid, and napthalene.

The price outlook for vegetable oils and animal fats is decidedly strong. To begin with, the output of crude cottonseed oil is so closely sold that only limited amounts may be expected to reach the market until new crop oil becomes available next season. The main competing material—lard—is in large with recent production running high and stocks showing a very large increase. But the stocks are being firmly held and a sharp drop in production is anticipated. The shipping situation has curtailed supplies of copra and coconut oil and while this may be regarded as a temporary condition, the scarcity of supplies in world markets makes it apparent that a long time must elapse before a return to normal may be expected.

Tallow is selling at high prices, yet it is relatively the lowest priced fat available. Recent cables from the Argentine indicated that Europe had been buying tallow in that country at prices above the parity of the domestic market.

A new schedule of prices for phenol quotes tank cars, 12¾c a lb.; large drums, 13¼-14c a lb.; 200-lb. drums, 13¾-14¼c a lb.; tin-lined drums, 14-14¼c a lb.; and crated tins, 14¼-16c a lb.

In the naval stores industry, attention is attracted to the steady advance in price for all grades of rosin. The policy of restricting output which has been in effect this year had a stimulating effect on values and the program for next year calls for a production about the same as was realized this year. If carried out as planned this lays the foundation for firm prices and for at least the first quarter of next year a strong market is probable.

Export trade in chemicals, according to the Department of Commerce records, attained a value of $14,472,000 in October, a total not reached in any previous month in six years. Outstanding gains were recorded in outward shipments of industrial chemicals, chemical specialties, fertilizers, and medicinal products. Foreign shipments of industrial chemicals, including acids, alcohols, sodium compounds, sulphur, etc., were valued at $3,230,000, representing an increase of 14 per cent over the September total.

The United States Supreme Court has declined to review three cases, in which the legality of the 3 cent per pound Federal tax on cocoanut oil from the Philippines. Two of the cases were filed by the Iowa Soap Co. and the Haskins Brothers & Co. of Omaha, Neb., while the Haskins company filed a third suit, seeking to enjoin the Secretary of the Treasury from paying to the Philippines the fund built up by the cocoanut oil tax, and authorized to be paid to the Island government by the act passed in 1934. The District of Columbia found this last was not a suit against the Secretary but against the government which has not consented to be sued. It also found the company had an adequate remedy at law.

Plans for the formal series of open hearings on the potash situation will be completed when the Pitman Committee, which has been holding informal meetings in the field, gets back to Washington and settles down to work. It is probable that the hearings will be held in Washington soon after the next congressional session opens.

Use of steam distilled pine oil as a denaturant for vegetable oils has been authorized under the ruling of the Bureau of Customs. The ruling calls for the addition of 100 fluid ounces of pine oil to each 100 gallons of the vegetable oil to be denatured.

Plans for the erection of a plant in Switzerland for the manufacture of sugar and alcohol from wood are reported to be well advanced. The cost of the project which is to be financed by the Central Bank of Graubunden is said to be in the neighborhood of 1,400,000 francs.

A plant for the manufacture of higher fatty alcohols has been established at Budapest which in addition to supplying the domestic demand plans to produce a certain amount for export.

The Irish Free State is rapidly becoming self-sufficient insofar as its soap requirements are concerned. Only 3,216 hundredweight were imported during the first eight months of the current year.

CHEM. & MET.
Weighted Index of
CHEMICAL PRICES

Base = 100 for 1927

This month	86.87
Last month	86.70
December, 1935	87.35
December, 1934	88.01

Adjustments of prices to changed costs of production have been more numerous. The price movement was in both directions with declines in acetone and formaldehyde. Naval stores were sharply higher and higher markets ruled for bichromate of soda, sulphate of ammonia, basic carbonate and sulphate of lead, and lead acetate.

CHEM. & MET.
Weighted Index of Prices for
OILS AND FATS

Base = 100 for 1927

This month	97.49
Last month	91.36
December, 1935	93.05
December, 1934	83.32

With the exception of linseed and China wood oils, almost the entire group of vegetable oils reached higher price levels in the last month. Crude menhaden oil was nominal. Animal fats were higher. Glycerine is scarce with sales at prices above those openly quoted.

Current PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to December 12.

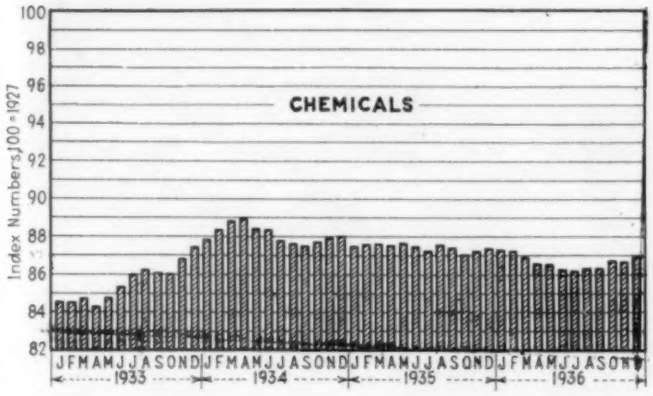
Industrial Chemicals

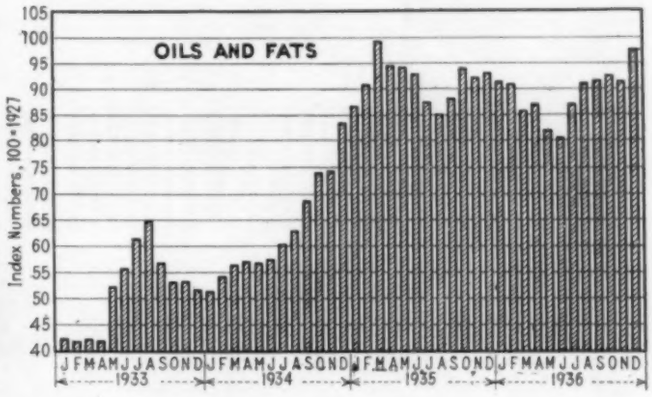
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.07 -$0.08	$0.08 -$0.09	$0.12-$0.12½
Acid, acetic, 28%, bbl., cwt.	2.45 - 2.70	2.45 - 2.70	2.45 - 2.70
Glacial 99%, drums	8.43 - 8.68	8.43 - 8.68	8.43 - 8.68
U. S. P. reagent	10.52 -10.77	10.52 -10.77	10.52 -10.77
Boric, bbl., ton	105.00-115.00	105.00-115.00	105.00-115.00
Citric, kegs, lb.	.25 - .28	.25 - .28	.28 - .31
Formic, bbl., ton	.11 - .11½	.11 - .11½	.11 - .11½
Gallic, tech., bbl., lb.	.60 - .65	.60 - .65	.60 - .65
Hydrofluoric 30% carb., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Lactic, 44%, tech., light, bbl., lb.	.11½- .12	.11½- 12	.12 - .12½
Muriatic, 18°, tanks, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18 50 -20 00	18.50 -	18.50 -20.00
Oxalic, crystals, bbl., lb.	.11½- .12½	.11½- .12½	.11½- .12½
Phosphoric, tech., c'boys., lb.	.09 - .10	.09 - .10	.09 - .10
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Sulphuric, 66°, tanks, ton	15.50 -	15.50 -	15.50 -
Tannic, tech., bbl., lb.	.20 - .30	.20 - .30	.23 - .35
Tartaric, powd., bbl., lb.	.24 - .25	.24 - .25	.24 - .25
Tungstic, bbl., lb.	1.50 - 1.60	1.50 - 1.60	1.50 - 1.60
Alcohol, Amyl	-	-	-
From Pentane, tanks, lb.	14.3 -	14.3 -	.15 -
Alcohol, Butyl, tanks, lb.	.08½-	.08½-	.12 -
Alcohol, Ethyl, 190 p'f., bbl., gal.	4.14 -	4.14 -	4.27½-
Denatured, 190 proof, No. 1 special, dr., gal wks.	.32 -	.32 -	.34 -
Alum, ammonia, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Potash, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Aluminum sulphate, com bags cwt.	1.35 - 1.50	1.35 - 1.50	1.35 - 1.50
Iron free, bg., cwt.	2.00 - 2.25	2.00 - 2.25	1.90 - 2.00
Aqua ammonia, 26°, drums, lb.	.02½- .03	.02½- .03	.02½- .03
tanks, lb.	.02½- .02½	.02½- .02½	.02½- .02½
Ammonia, anhydrous, cyl., lb.	.15½- .16	.15½- .16	.15½- .16
tanks, lb.	.04½-	.04½-	.04½-
Ammonium carbonate, powd. tech., casks, lb.	.08 - .12	.08 - .12	.08 - .12
Sulphate, wks., cwt.	1.25 -	1.25 -	1.20 -
Amylacetate tech., tanks, lb.	.12 - .13⅝	.12 - .13⅝	.142-
Antimony Oxide, bbl., lb.	.12½- .13½	.12½- .13½	.14 - .14½
Arsenic, white, powd., bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Red, powd., kegs, lb.	.15½- .16	.15½- .16	.15½- .16
Barium carbonate, bbl., ton	56.50 -58.00	56.50 -58.00	56.50 -58.00
Chloride, bbl., ton	72.00 -74.00	72.00 -74.00	72.00 -74.00
Nitrate, cask, lb.	.08½- .09	.08½- .09	.08½- .09
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.00 - 2.10	2.00 - 2.10	1.90 - 2.00
Borax, gran., bags, ton	44.00 -49.00	44.00 -49.00	44.00 -49.00
Bromine, cs., lb.	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags	2.10 -	2.10 -	2.10 -
Arsenate, dr., lb.	.06 - .07	.06 - .07	.06 - .07
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., del., ton	20.00 -33.00	20.00 -33.00	20.00 -33.00
flake, dr., del., ton	22.00 -35.00	22.00 -35.00	22.00 -35.00
Phosphate, bbl., lb.	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums, lb.	.05½- .08½	.05½- .06	.05½- .06
Chlorine, liquid, tanks, wks., lb.	2.15 -	2.15 -	2.15 -
Cylinders	.05½- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb.	1.41 - 1.51	1.41 - 1.51	1.39 - 1.45
Copperas, bgs., f.o.b., wks., ton	15.00 -16.00	15.00 -16.00	15.00 -16.00
Copper carbonate, bbl., lb.	.08½- .16	.08½- .16	.08½- .16
Sulphate, bbl., cwt.	4.15 - 4.40	4.15 - 4.40	3.85 - 4.00
Cream of tartar, bbl., lb.	.16½- .17	.16½- .17	.16½- .17
Diethylene glycol, dr., lb.	.16½- .20½	.16½- .20½	.16½- .20½
Epsom salt, dom., tech., bbl., cwt.	1.80 - 2.00	1.80 - 2.00	2.10 - 2.15
Ethyl acetate, drums, lb.	.07 -	.07 -	.08½-
Formaldehyde, 40%, bbl., lb.	.05½- .06½	.06 - .07	.06 - .07
Furfural, dr., lb.	.10 - .17½	.10 - .17½	.10 - .17½
Fusel oil, ref., drums, lb.	.16 - .18	.16 - .18	.16 - .18
Glaubers salt, bags, cwt.	.85 - 1.00	.85 - 1.00	1.00 - 1.10
Glycerine, e.p., drums, extra, lb.	.21½-	.19½-	.14 - .14½
Lead:			
White, basic carbonate, dry casks, lb.	.06½-	.06½-	.06½-
White, basic sulphate, sck., lb.	.06½-	.06 -	.06 -
Red, dry, sck, lb.	.07½-	.07½-	.07 -
Lead acetate, white crys., bbl., lb.	.11 - .11½	.11 - .11½	.10½- .11
Lead arsenate, powd., bbl., lb.	.09 - .10	.09 - .10	.09 - .10
Lime, chem., bulk, ton	8.50 -	8.50 -	8.50 -
Litharge, pwd., csk., lb.	.06½-	.06½-	.06 -
Lithophone, bags, lb.	.04½- .04½	.04½- .04½	.04½- .05
Magnesium carb., tech., bags, lb.	.06½- .06½	.06 - .06½	.06 - .06½
Methanol, 95%, tanks, gal.	.33 -	.33 -	.33 -
97%, tanks, gal.	.34 -	.34 -	.34 -
Synthetic, tanks, gal.	.35½-	.35½-	.35½-
Nickel salt, double, bbl., lb.	.13 - .13½	.13 - .13½	.12½- .13
Orange mineral, csk., lb.	.10½-	.10½-	.10 -
Phosphorus, red, cases, lb.	.44 - .45	.44 - .45	.44 - .45
Yellow, cases, lb.	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.08½- .09	.08½- .09	.07½- .08½
Carbonate, 80-85%, calc. csk., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Chlorate, powd., lb.	.08 - .08½	.08 - .08½	.08½- .09
Hydroxide (c'stic potash) dr., lb.	.06½- .06½	.06½- .06½	.06½- .06½
Muriate, 80% bgs., ton	23.00 -	23.00 -	22.00 -
Nitrate, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb.	.18½- .19	.18½- .19	.18½- .19
Prussiate, yellow, casks, lb.	.18 - .19	.18 - .19	.18 - .19
Sal ammoniac, white, casks, lb.	.04½- .05	.04½- .05	.04½- .05
Salsoda, bbl., cwt.	1.00 - 1.05	1.00 - 1.05	1.00 - 1.05
Salt cake, bulk, ton	13.00 -15.00	13.00 -15.00	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 -	1.23 -	1.23 -
Dense, bags, cwt.	1.25 -	1.25 -	1.25 -
Soda, caustic, 76%, solid, drums, contract, cwt.	2.60 - 3.00	2.60 - 3.00	2.60 - 3.00
Acetate, works, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Bicarbonate, bbl., cwt.	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb.	.06½- .07	.06½- .07	.05½- .06½
Bisulphate, bulk, ton	15.00 -16.00	15.00 -16.00	15.00 -16.00
Bisulphite, bbl., lb.	.03½- .04	.03½- .04	.03 - .04
Chlorate, kegs, lb.	.06½- .06½	.06½- .06½	.06½- .06½
Chloride, tech., ton	12.00 -14.75	12.00 -14.75	12.00 -14.75
Cyanide, cases, dom., lb.	.15½- .16	.15½- .16	.15½- .16
Fluoride, bbl., lb.	.07½- .08	.07½- 08	.07½- .08
Hyposulphite, bbl., cwt.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt.	2.15 - 3.15	2.15 - 3.15	3.25 - 3.40
Nitrate, bags, cwt.	1.375-	1.375-	1 275-
Nitrite, casks, lb.	.07½- .08	.07½- .08	.07½- .07
Phosphate, dibasic, bbl., lb.	.022- .023	.022- .023	.022- .024
Prussiate, yel. drums, lb.	.10 - .11	10 - .11	.11½- .12
Silicate (40° dr.) wks., cwt.	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb.	.02½- .03½	.02½- .03	.02½- .03
Sulphite, cyrs., bbl., lb.	.02½- .02½	.02½- .02½	.02½- .02½
Sulphur, crude at mine, bulk, ton.	18.00 -	18.00 -	18.00 -
Chloride, dr., lb.	.03½- .04	.03½- .04	.03½- .04
Dioxide, cyl., lb.	.06½- .08	.06½- .08	.07 - .07½
Flour, bag, cwt.	1.60 - 3.00	1.60 - 3.00	1.60 - 3.00
Tin Oxide, bbl., lb.	.52 -	.52 -	.54 -
Crystals, bbl., lb.	.38½-	.38½-	.37½-
Zinc, chloride, gran., bbl., lb.	.05 - .06	.05 - .06	.05 - .06
Carbonate, bbl., lb.	.09 - .11	.09 - .11	.09 - .11
Cyanide, dr., lb.	.36 - .38	.36 - .38	.36 - .38
Dust, bbl., lb.	.068- .07	.068- .07	.066- .07
Zinc oxide, lead free, bag., lb.	.05½-	.05½-	.05 -
5% lead sulphate, bags, lb.	.05½-	.05½-	.04½-
Sulphate, bbl., cwt.	2.65 - 3.00	2.65 - 3.00	2.75 - 3.00

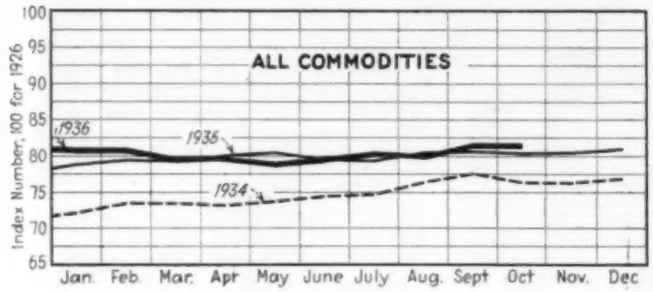
Oils and Fats

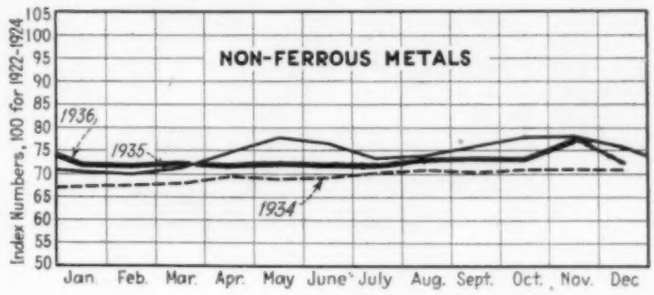
	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.10 -$0.11	$0.10 -$0.11	$0.10 -$0.11
Chinawood oil, bbl., lb.	.13½-	.13½-	.16½-
Coconut oil, Ceylon, tanks, N. Y. lb.	.07½-	.06½-	.04½-
Corn oil crude, tanks, (f.o.b. mill), lb.	.09½-	.08½-	.10½-
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.10 -	.08½-	.09½-
Linseed oil, raw car lots, bbl., lb.	.092-	.094-	.095-
Palm, casks, lb.	.05½-	.05 -	.04½-
Palm kernel, bbl., lb.	.05½-	.05½-	.05½-
Peanut oil, crude, tanks (mill), lb.	.09½-	.08½-	.09½-
Rapeseed oil, refined, bbl., gal.	.75 -	.73 -	.54 -
Soya bean, tank, lb.	.08½-	.08½-	.09 -
Sulphur (olive foots), bbl., lb.	.09½-	.09½-	.09 -
Cod, Newfoundland, bbl. gal.	.48 -	.48 -	.35 -
Menhaden, light pressed, bbl., lb.	.074-	.07 -	.072-
Crude, tanks (f.o.b.factory), gal.	.35 -	.30 -	.32 -
Grease, yellow, loose, lb.	.07½-	.06½-	.06 -
Oleo stearine, lb.	.09 -	.10 -	.11½-
Red oil, distilled, d.p. bbl., lb.	.09½-	.09½-	.09½-
Tallow, extra, loose, lb.	.07½-	.06½-	.06½-

CHEM. & MET.'S WEIGHTED PRICE INDEXES









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude, bbl., lb.	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.62
Refined, bbl., lb.	.80 – .85	.80 – .85	.80 – .85
Alpha-napthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.14½– .15	.14½– .15
Aniline salts, bbl., lb.	.24 – .25	.24 – .25	.24 – .52
Benzaldehyde, U.S.P., dr., lb.	1.10 – 1.25	1.10 – 1.25	1.10 – 1.25
Benzidine base, bbl., lb.	.65 – .67	.65 – .67	.65 – .67
Benzoic acid, U.S.P., kgs., lb.	.48 – .52	.48 – .52	.48 – .52
Benzyl chloride, tech., dr., lb.	.30 – .35	.30 – .35	.30 – .35
Benzol, 90%, tanks, works, gal.	.16 – .18	.16 – .18	.15 – .16
Beta-napthol, tech., drums, lb.	.23 – .24	.24 – .27	.22 – .24
Cresol, U.S.P., dr., lb.	.10 – .11	.10 – .11	.11 – .11½
Cresylic acid, 99%, dr., wks., gal.	.73 – .75	.73 – .75	.45 – .46
Diethylaniline, dr., lb.	.55 – .58	.55 – .58	.55 – .58
Dinitrophenol, bbl., lb.	.29 – .30	.29 – .30	.29 – .30
Dinitrotoluen, bbl., lb.	.16 – .17	.16 – .17	.16 – .17
Dip oil, 25%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, bbl., lb.	.38 – .40	.38 – .40	.38 – .40
H-acid, bbl., lb.	.65 – .70	.65 – .70	.65 – .70
Napthalene, flake, bbl., lb.	.07½– .07½	.07½– .07½	.05½– .06
Nitrobenzene, dr., lb.	.08½– .09	.08½– .09	.08½– .10
Para-nitraniline, bbl., lb.	.45 – .47	.51 – .55	.51 – .55
Phenol, U.S.P., drums, lb.	.13½– .14	.14½– .15	.14½– .15
Picric acid, bbl., lb.	.30 – .40	.30 – .40	.30 – .40
Pyridine, dr., gal.	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Resorcinal, tech., kegs, lb.	.65 – .70	.65 – .70	.65 – .70
Salicylic acid, tech., bbl., lb.	.40 – .42	.40 – .42	.40 – .42
Solvent naptha, w.w., tanks, gal.	.26 –.....	.26 –.....	.26 –.....
Tolidine, bbl., lb.	.88 – .90	.88 – .90	.88 – .90
Toluene, tanks, works, gal.	.30 –.....	.30 –.....	.30 –.....
Xylene, com., tanks, gal.	.30 –.....	.30 –.....	.30 –.....

Miscellaneous

	Current Price	Last Mont	Last Year
Barytes, grid., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb.	.17½– .18	.17 – .18	.15 – .16
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04 – .20	.04 – .20	.04 – .20
Prussian blue, bbl., lb.	.37 – .38	.37 – .38	.36½– .37
Ultramarine blue, bbl., lb.	.10 – .26	.10 – .26	.06 – .32
Chrome green, bbl., lb.	.26 – .27	.26 – .27	.26 – .27
Carmine red, tins, lb.	4.00 – 4.40	4.00 – 4.40	4.00 – 4.40
Para toner, lb.	.75 – .80	.80 – .85	.80 – .85
Vermilion, English, bbl., lb.	1.69 – 1.72	1.69 – 1.72	1.58 – 1.60
Chrome yellow, C. P., bbl., lb.	.13 – .14	.13 – .14	.14 – .16
Feldspar, No. 1 (f.o.b. N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 – .08½	.07 – .08½	.07 – .08½
Gum copal Congo, bags, lb.	.09 – .10	.09 – .10	.09 – .10
Manila, bags, lb.	.09 – .10	.09 – .10	.16 – .17
Damar, Batavia, cases, lb.	.13½– .16	.13½– .16	.15½– .16
Kauri No. 1 cases, lb.	.19 – .25	.19 – .25	.20 – .25
Kieselguhr (f.o.b. N. Y.), ton.	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc, ton.	50.00 –.....	50.00 –.....	50.00 –.....
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	.03 – .40	.03 – .40	.03 – .35
Rosin, H., bbl.	10.65 –.....	8.00 –.....	5.50 –.....
Turpentine, gal.	.45½–.....	.42½–.....	.49 –.....
Shellac, orange, fine, bags, lb.	.25 –.....	.25 –.....	.25 –.....
Bleached, bonedry, bags, lb.	.17½–.....	.17½–.....	.24 –.....
T. N. bags, lb.	.13½–.....	.13½–.....	.16 –.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 –10.00	7.50 –10.00	7.50 –11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 –.....	13.75 –.....	13.75 –.....

INDUSTRIAL NOTES

DOW CHEMICAL CO., Midland, Mich., has opened a sales office at 135 South LaSalle St., Chicago. Wilson I. Doan, formerly manager of the St. Louis office, is in charge.

THE NEWARK WIRE CLOTH CO., Newark, N. J., has appointed Harry G. Mouat as its representative in Birmingham, Ala. and W. C. Myers as its representative in Tulsa, Okla.

LEEDS & NORTHRUP CO., Philadelphia, has opened a new branch office at 75 Pearl St., Hartford, Conn.

PRODUCTIVE EQUIPMENT CORP., 4600 S. Kedzie St., Chicago, has established a research department which offers free service to industries which have screening problems.

LINK-BELT CO., Chicago, has appointed P. B. Engstrom as its distributor of shovels, draglines, and cranes in Los Angeles and Southern California territory.

GENERAL DYESTUFF CORP., New York, is now coordinated under one roof in a newly erected nine story building at 435 Hudson St.

CORNING GLASS WORKS, Corning, N. Y., has acquired the Macbeth-Evans Glass Co., Pittsburgh, with its two manufacturing plants at Charleroi, Pa., and Elwood, Ind.

THE WITCO CARBON CO., was formed recently to operate what is described as one of the largest carbon black units in the world. Robert I. Wishnick is president of the company. Headquarters are at 295 Madison Ave., New York, with a branch office at Amarillo, Texas. The plant will be located at Sunray, Texas.

BRISTOL'S INSTRUMENT CO., LTD., London, England, has moved into a new home at Brent Crescent, North Circular Road, West Twyford. This property was purchased to allow for an expansion program being followed by the associated companies, The Bristol Co. of Canada, Ltd., Toronto, and The Bristol Co., Waterbury, Conn.

SPENCER KELLOGG & SONS CO., Buffalo, N. Y., is erecting a plant at Long Beach, Calif., to crush California flaxseed and other oil-bearing materials.

New CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative 1938	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$37,000	.....	$577,000	$1,303,000
Middle Atlantic	348,000	$1,600,000	14,060,000	13,464,000
South	240,000	5,718,000	22,288,000	22,120,000
Middle West	6,925,000	374,000	16,929,000	9,334,000
West of Mississippi	3,287,000	414,000	10,000,000	10,886,000
Far West	650,000	.....	5,340,000	7,101,000
Canada	1,340,000	590,000	15,745,000	9,624,000
Total	$12,827,000	$8,696,000	$84,939,000	$73,832,000

PROPOSED WORK

BIDS ASKED

Brick Factory—Kilgard Brick Co., Ltd., New Westminster, B. C., Can., is having plans prepared for the construction of a factory for the manufacture of bricks (fire). New machinery will be purchased. Estimated cost $40,000.

Chemical Plant—The Arner Chemical Co., Ltd., Fort Erie, Ont., Can., plans to construct an addition to its plant. Estimated cost $40,000.

Chemical Plant—Cataract Chemical Co., Inc., 52 West Chippewa St., Buffalo, N. Y., plans to constuct a plant at Fort Erie, N. Y., for manufacturing products for tanners and shoe manufacturers.

Cotton Seed Oil Mill—Fidelity Products Co., Brownsville, Tex., subsidiary of Wesson Oil-Snowdrift Co., Canal Bank Bldg., New Orleans, La., has purchased a 9-acre site near Harlingen, Tex., and plans to construct a large cotton seed oil mill. All modern machinery and equipment will be installed.

Distillery—Corporation c/o William Gordon, 1624 Penn St., Des Moines, Ia., has acquired a plant at Fort Dodge, Ia., and plans to alter same into distillery. Estimated cost will exceed $50,000.

Distillery—Oldetyme Distilleries Corp., 122 East 42d St., New York, N. Y., has acquired the property of the Hammondsport Vintage Corp., 135 Benham St., Penn Yan, N. Y., and plans extensive improvements and additions for its own use. Estimated cost will exceed $37,000.

Enameling Plant—S. G. Adams Co., Stephen S. Adams, Pres., 412 North Sixth St., St. Louis, Mo., plans to construct an addition to its plant at Delmar and Garrison Aves. Maturity in 1937.

Factory—Kokomo Sanitary Pottery Co., Kokomo, Ind., is adding new buildings and equipment to its plant estimated to cost $50,000. The company has also purchased the plant of the Globe Brass Co., Cleveland, O., and will move same to Kokomo. New buildings will be erected estimated to cost $75,000.

Factory—W. R. Vanderwecker, Schuylerville, N. Y., plans to rebuild his hide and tallow plant recently destroyed by fire. Estimated cost will exceed $37,000.

Fertilizer Factory—Southern States Cooperative Fertilizer Service, Richmond, Va., contemplates the construction of a plant at Baltimore, Md. Estimated cost $200,000.

Gas Plant—Seattle Gas Co., Gasco Bldg., Seattle, Wash., plans to construct an auxiliary plant involving four new generators. Estitmated cost $500,000.

Laboratory—Lewis Foundry & Machine Co. (division of Blaw-Knox Co.), Groveton, Pa., is receiving bids for the construction of a 1 story, 25x125 ft. mechanical plant laboratory 18 ft. high and chemical laboratory 12 ft. high. Walter Nuttall, Purchasing Agent. Hunting, Davis & Dunnells, Century Bldg., Pittsburgh, Archts.

Paint Factory—Murphy Co., Ltd., 2735 Manufacturers St., Montreal, Que., Can., is having plans prepared by Sydney Comber, Archt., 630 Dorchester St., W., Montreal, for an addition to its paint factory. Estimated cost $60,000.

Paper Plant—Champion Paper & Fibre Co., Hamilton, O., plans to construct an additional unit to plant now being built on Houston Ship Channel near Pasadena, Tex. W. R. Crute in charge. Estimated cost $3,000,000.

Plywood Plant—Harbor Plywood Corp., Aberdeen, Wash., will soon receive bids for the construction of an addition to its plant. Estimated cost including machinery $150,000.

Powder Factory—National Powder Co., Duke Center, Pa., plans to construct an addition to its plant at Eldred, Pa., for the manufacture of high explosives. Estimated cost will exceed $100,000.

Rayon Mill—Industrial Rayon Corp., H. S. Rivitz, Pres., West 98 St. and Walford Ave., Cleveland, O., plans to construct a mill on Parmly St. near Painesville, O., to include main building, power house, chemical building and filtration plant. Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, Archt. and Engr. Estimated cost $5,000,000.

Refinery—Dixie Refining Co., c/o Dixie Fuel & Supply Co., 301 South Cavalry St., Detroit, Mich., plans to construct an oil refining and cracking plant on Fort St., Riverview (Wyandotte P. O.) Mich. Estimated cost $1,300,000.

Refinery—J. W. Fraser Refining Co., Ltd., Wainwright, Alta., Can., plans to construct an extension to its refinery. Estimated cost $50,000.

Refinery—Parade Gasoline Co., Shreveport, La., plans improvements to its refinery at London, Tex. Estimated cost will exceed $100,000.

Rubber Factory—Armstrong Rubber Co., 475 Elm St., New Haven, Conn., is receiving bids for a 3 story, 45x108 ft. factory. Fletcher-Thompson, Inc., 1336 Fairfield Ave., Bridgeport, Archt.

Rubber Factory—Manhattan Rubber Manufacturing Co. (Raybestos-Manhattan, Inc.), Willett St., Passaic, N. J., plans to construct an addition to its factory. $100,000.

Tung Oil Plant—Corporation c/p M. L. Mays, Chamber of Commerce Bldg., Cairo, Ga., contemplates the construction of a tung oil plant. Estimated cost will exceed $40,000.

Sugar Refinery—Canadian Sugar Refineries, Ltd., Raymond, Alta., Can., plans to construct extensions to its factories at Raymond and Picture Butte, Alta. Estimated cost $50,000.

Sugar Beet Factory—J. M. Carruthers and M. G. MacVicar, Winnipeg, Man., Can., are having plans prepared for the construction of a sugar beet factory. Estimated cost of factory $600,000; equipment $500,000.

CONTRACTS AWARDED

Batch House—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa., has awarded the contract for pile driving and concrete work for batch house to James Stewart & Co., 343 South Dearborn St., Chicago, Ill. Total estimated cost $200,000.

Bleach Plant—Hammermill Paper Co., East Lake Rd., Erie, Pa., has awarded the contract for the construction of a bleach plant to H. Platt Co., 922 Raspberry St., Erie, Pa. Estimated cost $25,000.

Cement Plant—Universal Atlas Cement Co., subsidiary of U. S. Steel Corp., 208 South La Salle St., Chicago, Ill., will construct addition to cement plant at Hudson, N. Y., by own forces. Estimated cost $1,000,000.

Crude Oil Treating Plant—Ohio Oil Co., Medecine Bow, Mont., has awarded the contract for the construction of a crude oil rectifying plant to Braum & Co., Alhambra, Calif. Estimated cost $110,000.

Distillery—The Meadville, Pa. Distillery Co., Inc., T. Kratz, Supt. in charge, Box 444, Meadville, Pa., has awarded contract for piling for proposed distillery to J. Lee Plummer, Inc., 2 Beaver Rd., Sewickley, Pa. All separate contracts will be awarded for work. Estimated cost $300,000.

Enameling Plant—Nu Enamel Corp., 2452 East 9 St., Cleveland, O., has awarded the contract for plant improvements to J. Huml, 3224 Albion Rd., Cleveland, O. Estimated cost may exceed $37,000.

Factory—Ruberoid Co., 9215 Riverview Dr., St. Louis, Mo., has awarded the contract for an addition to its factory and warehouse to H. B. Deal & Co., Inc., 1218 Olive St., St. Louis, Mo. Estimated cost $250,000.

Fertilizer Factory—Central Alabama Farmers Cooperative, B. L. Youngblood, Pres., Selma, Ala., will construct a fertilizer mixing and storage plant. Separate contracts have been awarded for the work. Estimated cost $38,000.

Fertilizer Factory—F. H. Heidner, 301 Metropolitan Bldg., Toronto, Ont., Can., has awarded the contract for the construction of a fertilizer plant to MacDonald Engineering Co., Ltd., 512 C.P.R. Bldg., Toronto. Estimated cost will exceed $100,000.

Gas Plant—Municipality, Plant City, Fla., has awarded the contract for the construction of a gas plant and distribution system to I. H. Smith Co., Jacksonville. Estimated cost $100,000.

Glass Factory—Corning Glass Works, Corning, N. Y., has awarded the contract for the construction of a fibre plant to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $75,000.

Laboratory—American Rolling Mill Co., Middletown, O., has awarded the contract for the construction of a research laboratory to Austin Co., 16112 Euclid Ave., Cleveland. Estimated cost $260,000.

Laboratory—State Highway Dept., Bismarck, N. D., has awarded the contract for the construction of a testing laboratory to John W. Larson, Bismarck, $53,800.

Paint Factory—Inter-Coastal Paint Corp., East St. Louis, Ill., has awarded the contract for the construction of a factory on Washington Ave., San Leandro, Calif., to H. F. Christensen Co., 1955 Webster St., Oakland.

Powder Factory—Republic Bronze Powder Co., A. H. Gross, Pres., 3000 Woodhill Rd., Cleveland, O., has awarded the contract for the construction of five buildings on Forbes Rd., Bedford, O., to Joseph Ruess, 399 Lloyd Rd., Cleveland. Estimated cost $40,000.

Pulp Plant—Brunswick Pulp & Paper Co., Brunswick, Ga., has awarded the contract for the construction of a pulp and paper plant to Stone & Webster Engineering Co., 90 Broad St., New York, N. Y. Estimated cost $3,500,000.

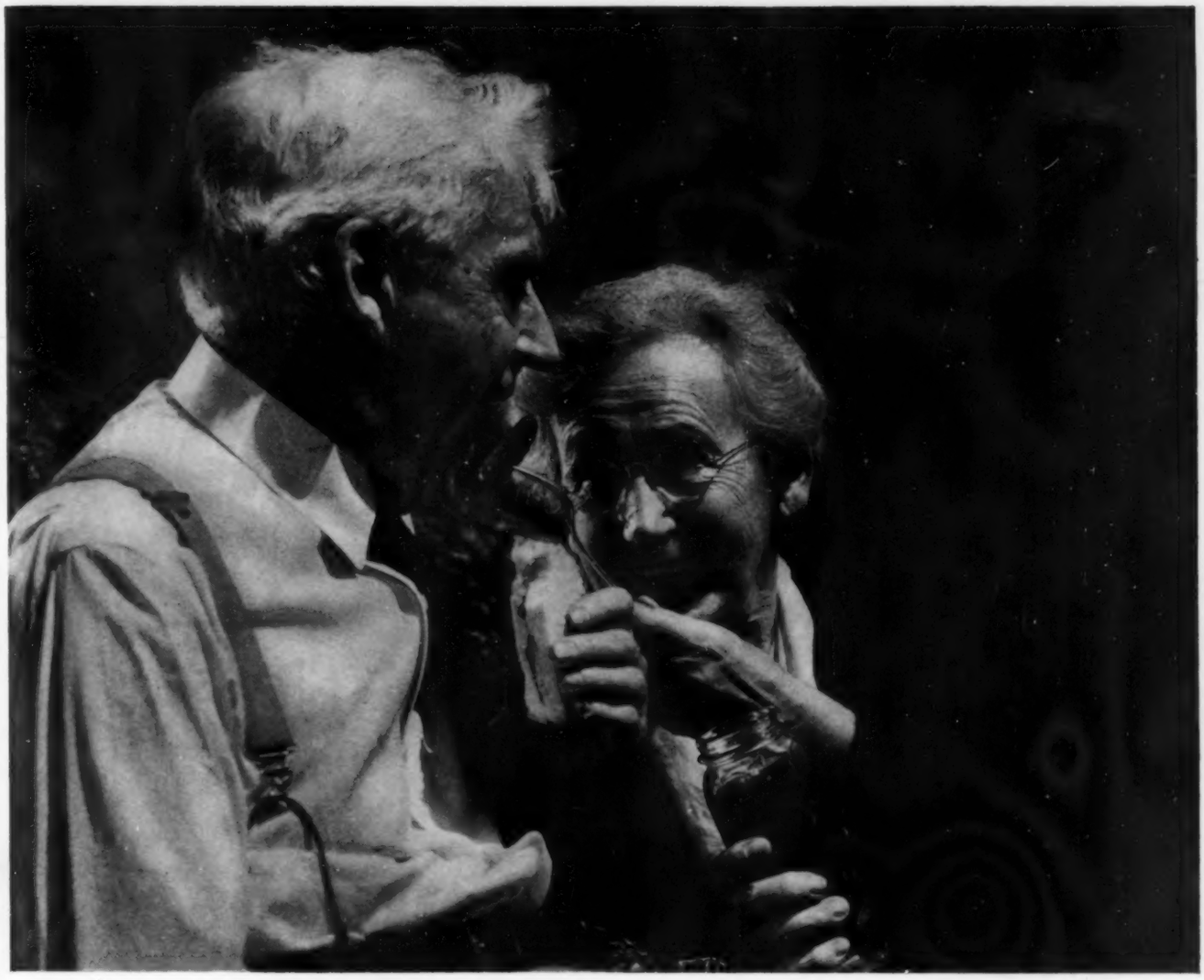
Pulp Mill—Kieckhefer Container Co., Delair, N. J., has awarded the contract for first unit of rayon mill on Roanoke River near Plymouth, N. C., to James Stewart & Co., 230 Park Ave., New York. Estimated cost first unit $1,000,000; total estimate $5,000,000.

Rayon Mill—Wilbert J. Carter, Greensboro, N. C., has awarded the contract for constructing mill for manufacturing acetate rayon and silk goods to C. W. Angle, Inc., Greensboro, N. C. Estimated cost including equipment, $750,000.

Starch Factory—Canada Starch Co., Ltd., 637 Craig St., W., Montreal, Que., Can., has awarded the contract for plant and office building to D. W. Ross and A. Lacroise, Ltd., 1010 St. Catherine St., W., Montreal, Que. Estimated cost $490,000.

Storage Building—Brown Paper Mills, Monroe, La., has awarded the contract for the construction of a storage building to Forcum-James Co., Dyersburg, Tenn. $150,000.

Warehouse—Frankfort Distilleries, Columbia Bldg., Louisville, Ky., has awarded the contract for the construction of a warehouse to Russell Construction Co., Jackson and Burnett Sts., Louisville. Estimated cost $180,000.



"Have another pickle, Dad?"

DAD and Mother are getting along in years, but they still like picnics.

When they were newly married, forty years ago, the picnics were more of a problem. Dad still likes to tell about the time they started out in their first two-cylinder auto, and had three blowouts before they finally got home. Now he gets twenty thousand miles out of his tires and scarcely gives them a thought . . .

. . . *never* thinks, in fact, of the rubber chemicals that have done so much to add life and safety to tires, because he never heard about them. Tires are just better, that's all.

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Every pound of DARCO, the Activated Carbon, contains billions of minute particles—each activated to give maximum adsorptive capacity. With DARCO you can control the Purity, Color, Odor, and Taste of your final product.

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TRADE MARK

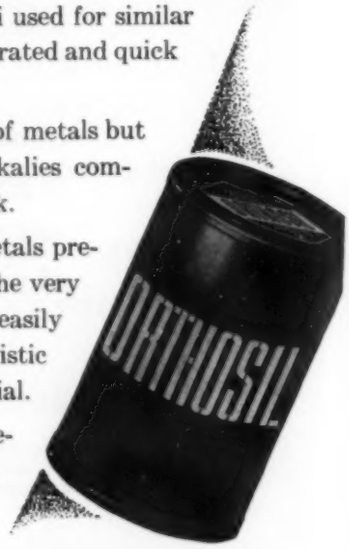
cuts time and cost of metal cleaning

STEEL manufacturers use Orthosil to prepare their steel for the application of a protective coating because it has properties shared by no other alkali used for similar purposes. This much desired anhydrous material is exceedingly concentrated and quick acting—unhampered by inert salts or weak alkaline diluents.

ORTHOSIL not only cuts the time required for heavy duty cleaning of metals but it minimizes storage space and handling. It costs less than other alkalies commonly used because smaller amounts of it are required to do the work.

ORTHOSIL solutions are remarkably efficient in cleaning ferrous metals preparatory to painting or plating. Orthosil removes dirt and oil from the very pores of the metal and leaves it clean except for traces of oxides easily removed by pickling. Metals cleaned with Orthosil have a characteristic bright appearance. Grease and dirt do not re-deposit on the material.

Orthosil is shipped in large drums, in the form of dry, clean, white, free-flowing granules—readily and completely soluble in water, hot or cold. Write for detailed information today. Address Department B.



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CARBIDE and Carbon Chemicals Corporation has, since its inception, conducted an organized program of research and development leading to the commercial production of over eighty aliphatic organic chemicals. Many of these compounds were made available for the first time in commercial quantities; still others were created to fill the needs of industry.

In the course of this development, much valuable information and experience have been gained. Success in such a program has depended as much upon a mastery of the raw material requirements of the chemical and process industries as upon a detailed knowledge of the properties and technology of the products themselves.

This knowledge of our chemicals, both as finished products of our work and as raw materials for our customers, has been an important factor in the development of many industrial applications. It is a guarantee of the excellence of the products we sell and of the accuracy of our recommendations for their use.

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Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York, N. Y.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

A Summary of the Products of
CARBIDE AND CARBON CHEMICALS CORPORATION

ALCOHOLS
- Methanol
- Ethanol
- Isopropanol
- Butyl Alcohol (Normal)
- Hexanol (Normal)
- Methyl Amyl Alcohol
- Ethyl Butyl Alcohol
- Octyl Alcohol

GLYCOLS
- Ethylene Glycol
- Propylene Glycol
- Diethylene Glycol
- Triethylene Glycol

ALCOHOL-ETHERS
- Methyl Cellosolve
- Cellosolve*
- Butyl Cellosolve
- Methyl Carbitol
- Carbitol*
- Butyl Carbitol

ETHERS AND OXIDES
- Ethyl Ether
- Isopropyl Ether
- Dioxan
- Dichlorethyl Ether
- Chlorex*
- Ethylene Oxide
- Carboxide*
- Propylene Oxide

ALDEHYDES
- Butyraldehyde
- Crotonaldehyde
- Octyl Aldehyde

KETONES
- Acetone
- Methyl Acetone
- Methyl Isobutyl Ketone
- Methyl Amyl Ketone

ACIDS AND ANHYDRIDES
- Acetic Anhydride
- Butyric Acid
- Butyric Anhydride

ESTERS
- Methyl Acetate
- Ethyl Acetate
- Isopropyl Acetate
- Butyl Acetate (Normal)
- Methyl Amyl Acetate
- Octyl Acetate
- 2-Ethyl Butyl Acetate
- Methyl Cellosolve Acetate
- Cellosolve Acetate
- Carbitol Acetate
- Diethyl Sulphate
- Ethyl Acetoacetate
- Methyl Acetoacetate
- Dimethyl Phthalate
- Dibutyl Phthalate
- Ethyl Silicate

CHLORINATED COMPOUNDS
- Ethylene Dichloride
- Propylene Dichloride
- Trichlorethylene
- Chloracol
- Ethylene Chlorhydrin
- Propylene Chlorhydrin
- Vinyl Chloride

AMINES
- Monoethanolamine
- Diethanolamine
- Triethanolamine
- Acetoacetanilide
- Ethylene Diamine
- Morpholine
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VINYLITE* RESINS

ACTIVATED CARBON

HYDROCARBON GASES
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- Ethylene
- Propane
- Pyrofax*
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- Commercial Butane
- Isobutane
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From raw cotton, wool, silk, and the chemicals of synthetic fibres to finished textiles there are many steps—chemical and mechanical—in which Hercules Powder Company materials speed processes, increase quality, decrease costs. Chemical cotton (base of synthetic fibres), grease solvents, dye assistants, and kier and sizing compounds are some of the Hercules products which serve the textile industry and other industries.

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★ **Some Industries Using Hercules Products:** Textile, Paper, Construction, Plastics, Metallurgical, Disinfectant, Insecticide, Paint, Varnish, Lacquer, Soap, Synthetic Fibres, Mining, Quarrying, Foundry, General Chemicals.

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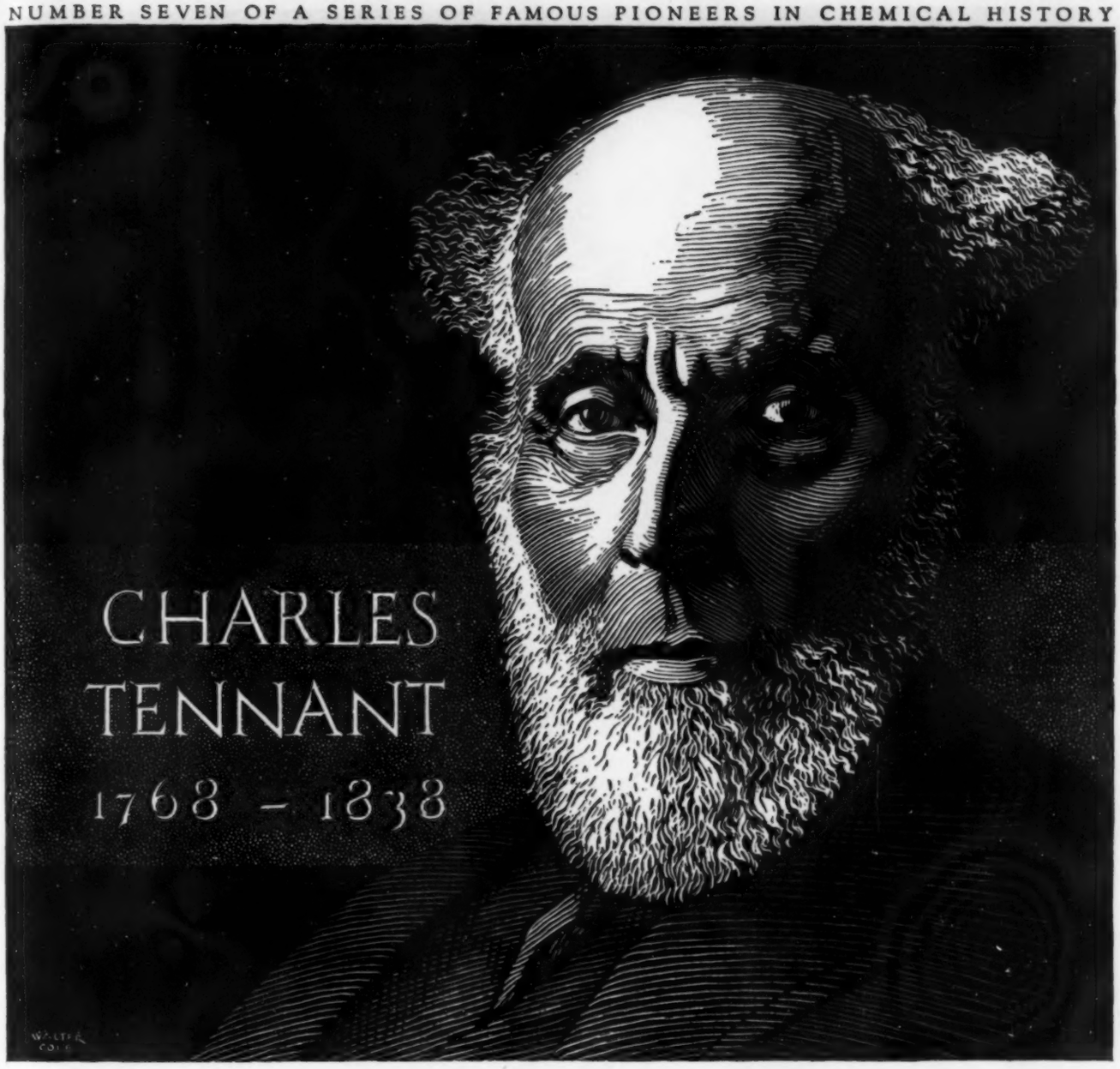

TEXTILE bleaching was shortened from a matter of months to a matter of hours when Charles Tennant, an "eminent practical chemist" of Glasgow, produced the first bleaching powder by saturating lime with chlorine. Others had recognized the possibilities offered by the decolorizing action of chlorine upon fabrics, but Tennant made chlorine available in commercial quantities in a form that could be transported and readily applied. In the United States, the earliest production of bleaching powder was in 1895, when Mathieson placed the first domestic product on the market. Since this early pioneering venture, Mathieson has been in the forefront of new developments in the production and distribution of chlorine and chlorine products and in the efficient application of these products in textile bleaching, in paper and pulp bleaching, in petroleum refining, in water purification and in other important fields.

In its Annual Proceedings of 1839, the Institution of Civil Engineers, London, said of Charles Tennant: "The great revolution in the practice of bleaching... was carried out by the discoveries made by him, first of the Solution of Chloride of Lime and afterwards of the dry Chloride of Lime, or bleaching powder—an inestimable gift to the arts with which the name of Mr. Tennant will always be associated. He... will long continue to be extensively known and associated with practical science."

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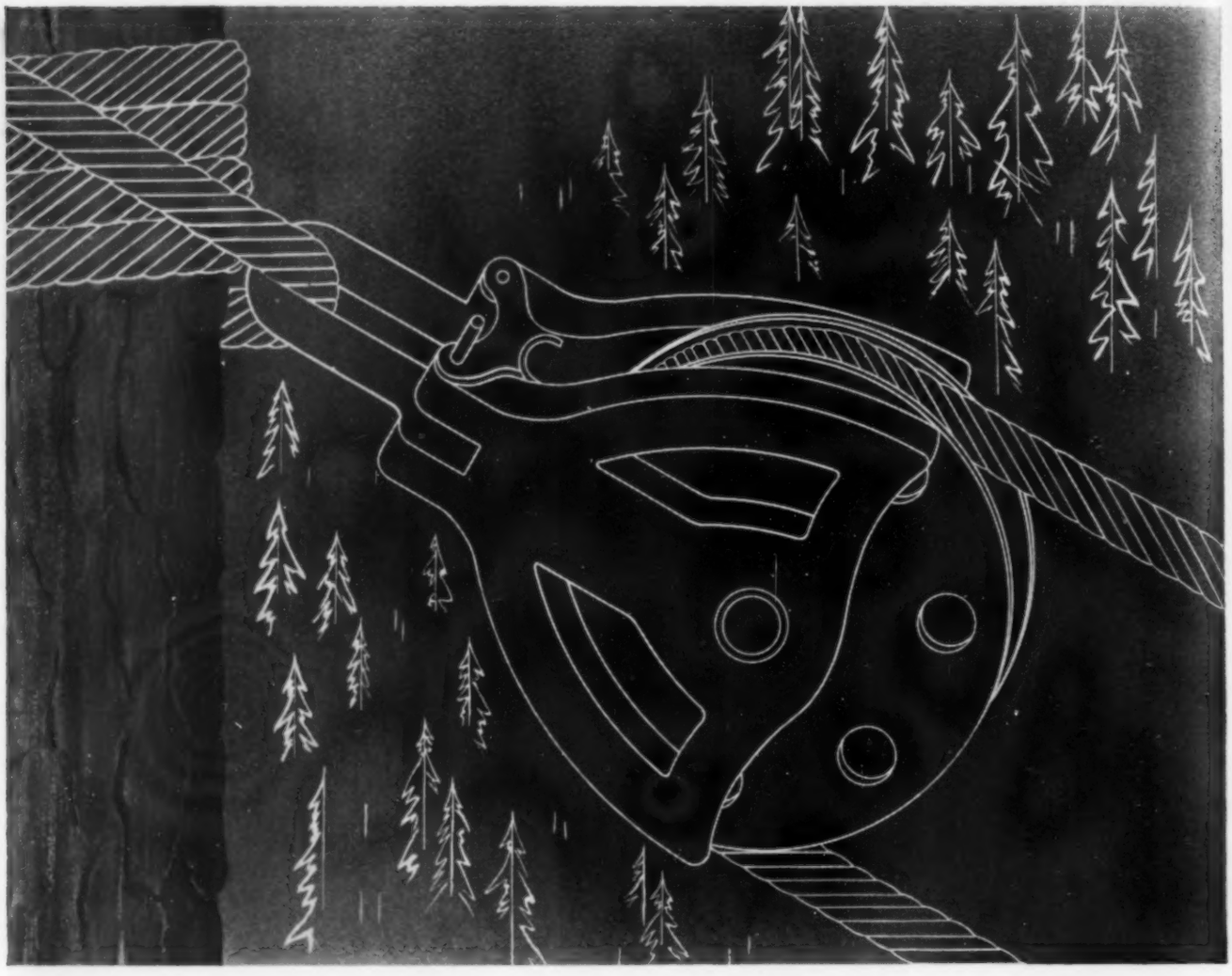

MOLY steel's greater strength means less weight—easier handling

WHEN operating equipment has to be handled by man-power, the importance of light weight through the use of the strongest possible material comes home with telling effect. Logging blocks, for example. Ask any rigger what a back-breaking job it is to tote them aloft. Think, too, of the abuse they get. . . . Dropped from great heights, battered and banged around, exposed to weather—it's a hard life they lead.

By making side frames and sheaves out of 2% Nickel-0.40% Moly steel, the weight of logging blocks can be reduced one-third to one-half—without sacrifice of strength. Similar foresight in the construction of other forms of industrial equipment can lead to corresponding savings in time, labor, wear, depreciation.

What do you make or use that would gain through lighter weight, higher strength, greater resistance to impact, abrasion, creep, corrosion? Look into Moly and its many-sided qualities for improving any steel or iron—whether plain or otherwise alloyed. Our helpful technical book, "Molybdenum," goes into the subject at considerable length. Yours for the asking—as is also our periodical news-sheet, "The Moly Matrix." If interested in some particular ferrous problem, our laboratory facilities are at your disposal.

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PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

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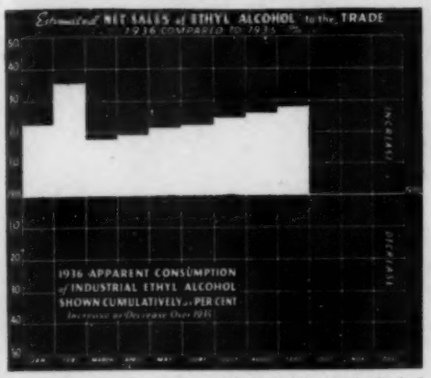
SOLVENT NEWS

Reg. U. S. Pat. Off.

December ★ A Monthly Series of Articles for Chemists and Executives of the Solvent-Consuming Industries ★ 1936


Estimated NET SALES of ETHYL ALCOHOL to the TRADE
1936 COMPARED TO 1935
1936 APPARENT CONSUMPTION
of INDUSTRIAL ETHYL ALCOHOL
SHOWN CUMULATIVELY... PER CENT

Apparent consumption of industrial ethyl alcohol from Jan. 1 to Sept. 31, 1936 was 44,578,000 wine gallons. This is 27.5 per cent greater than during the same period in 1935 when 34,956,000 wine gallons were consumed.

PASTEL SHADES PROMINENT ON '37 CARS AT AUTO SHOW

Mecca for new car buyers, the 1936 National Auto Show opened at Grand Central Palace, New York, on November 11th, amid the fanfare of increased buying activity. Again streamlining continued to have a major influence on color trends.

Luxurious pastel shades found greater acceptance than heretofore, although a number of higher-priced cars in the "chauffeur class" were shown in black. The metallic iridescent finishes, so popular at the 1935 show, appeared to have lost some ground. Body stripings and secondary colors were less in evidence, manufacturers inclining to greater use of cleverly styled chromium plating and monotone color effects in their place. Even disc wheels exhibited larger areas of metallic plating.

STUDY EFFECT OF OXALIC ACID ON SHELLAC SOLUTIONS

Further studies on the action of oxalic acid in retarding the darkening of shellac solutions in metallic containers have apparently established a relationship between the electric conductivity of such solutions and the amount of oxalic acid to be used.

Experiments on 20 per cent solutions of TN shellac in 98 per cent alcohol led to the observation that for a certain oxalic acid concentration, (usually between 0.04 per cent and 0.2 per cent) there was a conductivity minimum.

No direct relationship between darkening and the point of minimum conductivity was noted. However, it seemed apparent that the maximum bleaching effect of oxalic acid very nearly coincided with the point of minimum conductivity. In actual practice this would mean that concentrations of oxalic acid below 0.25 per cent are the optimum amounts to be used.

By way of explaining the observed phenomena, it has been suggested that ionization of the dissolved calcium and iron salts imparts a certain conductivity to the shellac solution. Adding oxalic acid precipitates these salts as insoluble oxalates and the conductivity is decreased upon addition of the optimum quantity of acid.

NITROCELLULOSE LACQUERS MAKE NEW GAINS IN RUBBER INDUSTRY

Changes in Rubber Compounding Technic Increase the Demand for "Tailor-Made" Lacquers

New achievements high-light the progress of lacquers in the rubber field. A lacquer film which will stretch 200-300 per cent was introduced to the rubber industry some months ago. Lacquer coated cables which will stand immersion in a bath of hot oil for forty hours at 220° F. and then bend around a one-half inch mandrel without cracking the finish are commercial products. From children's alphabet blocks to hot water bottles and galoshes, lacquers are important factors in marketing rubber products.

The use of lacquers in rubber is not new. For many years this type of coating has been recognized as a first line of defense against oxidation, dirt, water, gasoline, oils, and electrical corona. Beside their protective functions, colored lacquers have the obvious merit of glossing over and brightening drab-colored rubber stocks such as dolls. Rubber coated textiles are more pleasant to touch because of the smooth, non-tacky finish provided by the lacquer. To a large extent, the popularity of nitrocellulose lacquer in this field is due to its quick-drying and wide adaptability.

Unique Requirements

Many special requirements were presented; lacquers had to be "tailor-made." A lacquer perfectly satisfactory for the most flexible sheet of metal was far too brittle and non-extensible for rubber. Wetting of the rubber itself and subsequent adhesion of the lacquer film are major problems. But by far more unique to the use of lacquers in this field, are

(Continued on next page)

VICE-PRES. BACKUS MARKS HIS 20TH YEAR WITH U. S. I.

Arthur A. Backus, Vice-President in charge of Production of the U. S. Industrial Alcohol Co. and the U. S. Industrial Chemical Co., Inc. has just completed his twentieth consecutive year of service with U. S. I.

Beginning as research chemist, he became in turn, Research Director, Production Manager and Vice-President in Charge of Production.

Among the developments to which Mr. Backus has contributed is the process for producing esters from dilute acids (e. g., ethyl acetate from vinegar). The purification of Carbon Dioxide from fermentation of molasses occupied his early efforts to find uses for the by-products of alcohol manufacture. As a result of his endeavors this gas is now widely used in carbonated beverages.

He has been responsible for many innovations and improvements in the design of distillation equipment. During the past three years he has directed an extensive program of plant rehabilitation and modernization for U. S. I.

Pictures, Inc.

FLESH-COLORED LACQUER is sprayed on doll heads as shown above. The rosy cheeks of the doll are produced by spot touching the cheeks with a bright red lacquer previous to applying the flesh coat. This spot lacquer bleeds through to produce the desired shade. Eyebrows and lips are hand painted. Above is one of the spray booths at the Long Island City plant of the Ideal Novelty & Toy Co.

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DECEMBER ★ **SOLVENT NEWS** ★ 1936

BY-PRODUCT SOLVENT OILS FROM COKE SHOW PROMISE

High-boiling oils reported to possess excellent solvent properties have been recovered from residues of by-product coke plants. It is stated that the oils, largely aromatic hydrocarbons, can be produced in large quantities at low cost. They are solvents for rosin, resinates, many natural gums, synthetic resins, rubber and chlorinated rubber.

These oils are said to have the following characteristics: Boiling range: between 180° C. and 375° C. Specific gravity: 0.950 to 1.030 at 15.5° C. Corrosion: negative by copper strip test. Acid number: 0.1. They are miscible with most of the commercial organic solvents and are not affected by water, lime, alkalies, or dilute acids.

Possible applications for the new oils include such fields as paint, varnish and lacquer manufacture, wood preservatives, insecticides and fungicides, cleaning agents, floorings, and asphalt.

LACQUERS GAIN IN RUBBER FIELD

(Continued from preceding page)

requirements for resistance to the ingredients used in rubber items.

It is common practice to apply lacquers to many rubber articles before vulcanization, since there is often a gain in adhesion when this is done. This involves coating rubber which may be compounded with such diverse chemicals as sulphur, stearic acid, hydrocarbon softeners, pigments, and organic accelerators and anti-oxidants. Vulcanization may be under steam pressure at temperatures from 240° to 250° F. Under these conditions certain compounding ingredients may bloom out of the rubber with adverse effects on the lacquer.

Needless to say, the conventional nitrocellulose lacquer will not meet these requirements. Nitrocellulose tends to break down above 200° F. and plasticizers may be decomposed or driven off. Yet by proper formulation, nitrocellulose lacquers have been developed to meet these and tests even more severe. Nitrocellulose coated cables are now so made that when ignited they will extinguish themselves.

Formulation of lacquers which allow for unusual stretch has been effected by a clever compromise. Lacquer films are made to crack with invisible hairlines so that the lacquer between these microscopic breaks lies perfectly flat and retains good adhesion. Thus have been developed films which possess the characteristics necessary to compensate for the great disparity between the elasticity of the rubber and the film itself.

Application of lacquers to rubber is by dipping, brushing, spreading or spraying either before or after vulcanization. The kind of article, size and shape determine the method.

The perfect lacquer for rubber has not yet been produced and changes in rubber compounding practice herald the need for new lacquers. Still other types of rubber articles could utilize lacquer, leading up to a potentially greater field.

Railroads Use Super Pyro To Protect Air Cylinders

Railroad travel is made safer during the winter season through the use of Super Pyro. Last winter a number of Eastern railroads applied a quart of U. S. I.'s money-saving anti-freeze to locomotive air reverse cylinders and valves which have a tendency to "freeze-up" in cold weather. Just as in automobiles, this application of Super Pyro calls upon its ability to prevent rust and corrosion as well as to provide anti-freeze protection.

Standard practice is to blow out the Super Pyro after every ten hours of use, since moisture from the compressed air dilutes the alcohol. Loss due to operation of the gear also makes regular replacement necessary.

Transparent covering has been applied to such unrelated products as citrus fruits, cigarettes, tools and photographs by a cold dip process developed recently. The discoverer states that it may be colored, is waterproof and transparent, and can possibly be made fireproof.

Rolf Stein of Honeywill & Stein, Ltd., selling organization for Great Britain's largest alcohol and solvent producers, has just completed a two-month visit to this country. At the end of his stay, during which he visited the Baltimore plant of U. S. I., Mr. Stein said that British chemists should visit the United States more often to keep abreast with the latest developments.

TECHNICAL DEVELOPMENTS

The items in this column are gathered from many varied sources. Further information may be obtained by writing to U. S. I.

U S I

Collapsible tubes which require no screw caps or other closures are on the market. Materials which may use the new package include: colors in oil, japan driers, putties, plastic compositions and wood fillers. The neck of the tube is sealed by a slotted flexible diaphragm. Pressure on the tube causes the slot to open and the contents to flow out.

U S I

Rubber can be vulcanized direct to metal by a new simplified process recently developed. Flexible rubber-metal couplings, non-skid wheels, power pulleys and rolls are some of the forms which have been developed.

U S I

A 2-dip solvent degreasing machine for both immersion and vapor cleaning has recently been placed on the market. The work to be cleaned is usually immersed in a boiling chamber first, then cooled in a clean solvent rinse and finally suspended for a few seconds in pure solvent vapors.

U S I

A protective coating formulated with minute flakes of metallic copper in a liquid vehicle has been marketed. It is said to dry to a coating of pure metallic copper that is corrosion-proof, water-proof and fire resisting. The manufacturer states that it can be applied to metal, wood and concrete.

U S I

Photographs may be printed directly on such surfaces as rubber, fabrics and leather by a new process, according to reports. The results are said to be permanent and washable.

U S I

A process for casting rubber into various useful forms has been introduced into this country from England. A highly concentrated form of latex is mixed with a setting chemical and almost any compounding ingredients such as dyes, pigments, anti-oxidants and vulcanizing agents.

U S I

Measurement of both diffused and refracted light is the feature of a new photo-electric cell. The instrument, which is portable, may be applied directly to an enameled or lacquered surface. Readings can be made in absolute or comparative units.

Charts illustrating a simple method for determining the contents of 54-gal. drums by stick measurements may be secured by writing to U. S. I.

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Calcium Chloride
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Liquid—Granular Hydrated—Dustless Calcined
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The treatment of industrial water with CHEMICAL LIME has been found particularly effective for neutralizing acid wastes from steel mills—as a precipitant for tannery, paper mill and cane and beet sugar wastes—for neutralizing and coagulation in food industries—and many other similar applications.

There is a new trend also in sewage treatment, away from biochemical processes and toward the use of CHEMICAL LIME as a precipitant. Better overall economy and dependability are claimed for this modern lime-using process.

MARBLEHEAD again takes first place in the choice of chemical engineers for both of these processes because its high calcium chemical activity does the work more quickly, more thoroughly, and much more economically. Thus once again, Marblehead's top value is demonstrated—as it has been time after time in so many other chemical processes. Booklet "Modern Chemical Lime," on request.

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- PEBBLE LIME
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Chicago, Illinois Kansas City, Missouri

HIGH CALCIUM

MARBLEHEAD CHEMICAL LIME

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Controlled quality, controlled uniformity . . . these explain LOTOL's noteworthy achievements . . . these explain the rapid growth of the application of LOTOL throughout industry.

LOTOL* will improve the quality of *your* product. Invite our chemists into consultation.

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* Lotol is our trade name for Latex in any form.

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Division of United States Rubber Products, Inc.
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about du Pont
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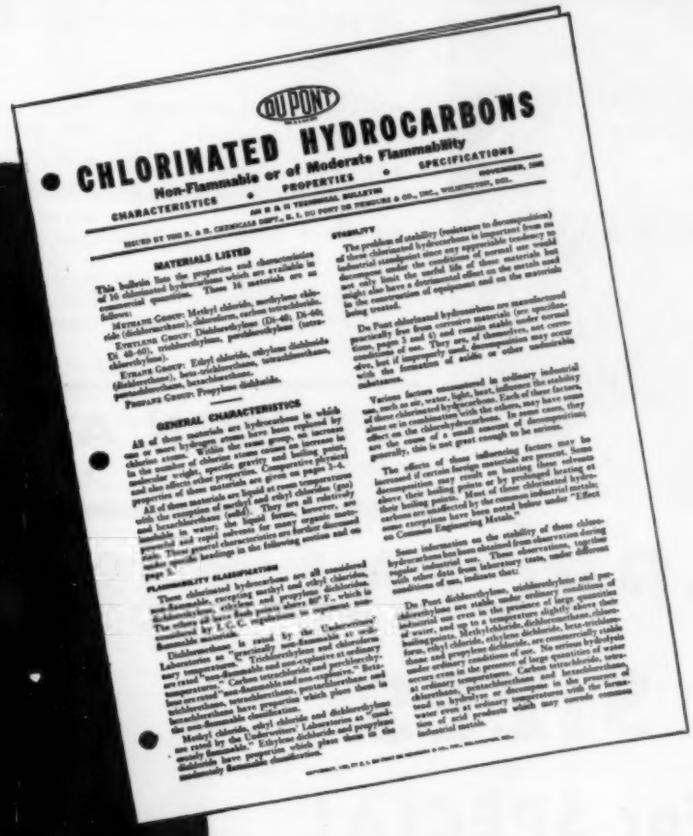
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MODIFIED SODAS
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in

CORROSION-PROOF CERAWARE

GENERAL CERAMICS COMPANY
CHEMICAL STONEWARE

Whether a ten-gallon mixing tank or a seven hundred gallon storage vessel . . . it will defy corrosion and effect substantial savings in repair and replacement costs if built of General Ceramics Ceraware.

The initial cost of Ceraware is low, and large stocks of many standard Ceraware Products are maintained for immediate deliveries. A brief letter will bring complete information.

GENERAL CERAMICS COMPANY • 30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

DU PONT
REG. U.S. PAT. OFF.

Ammonia Department Offers

PRODUCTS AND SERVICES

YOU CAN USE WITH PROFIT

AMMONIA PRODUCTS

- Anhydrous Ammonia (Refrigeration and Commercial Grades)
- Aqua Ammonia (26° Be., 29.4% NH_3.)
- Ammonium Carbonate
- Ammonium Bicarbonate
- Urea-Ammonia Liquor (For Ammoniation of Superphosphate Fertilizers)
- Crystal Urea (For General Technical and Fertilizer Use)

ALCOHOL PRODUCTS

- Methanol (Pure Synthetic)
- Normal Propanol (Technical)
- Isobutanol (Technical)
- Mixed Higher Alcohols (Fractions with Boiling Ranges 133° to 150°C., 150° to 160°C., 160° to 200°C., 200° to 275°C.)
- HYDRONOL and PONTOL K (Authorized Denaturants for Completely Denatured Alcohol)
- Also derivatives of alcohols such as aldehydes, acids, ketones, ethers and esters.

MISCELLANEOUS PRODUCTS

- ZERONE *Anti-Rust* Anti-Freeze
- Dimethyl Ether—Dimethyl Sulphate
- DYNAX (2-cycle Motor Speed fuel)
- DYNOL (Power Lubricant for 2-cycle Engines)
- Foam Inhibitor (For Steffen Beet Sugar and Kraft Black Liquor)
- Frothing Oil (For Ore Flotation)
- KETANOL (Softener for Nitrocellulose Plastic Sheet)
- OPALWAX (High-melting, oil-resistant Synthetic Wax)
- Sodium Formate

CUSTOM HYDROGENATION SERVICE

We are equipped to hydrogenate materials to your specifications, on any commercial scale, on a custom basis.

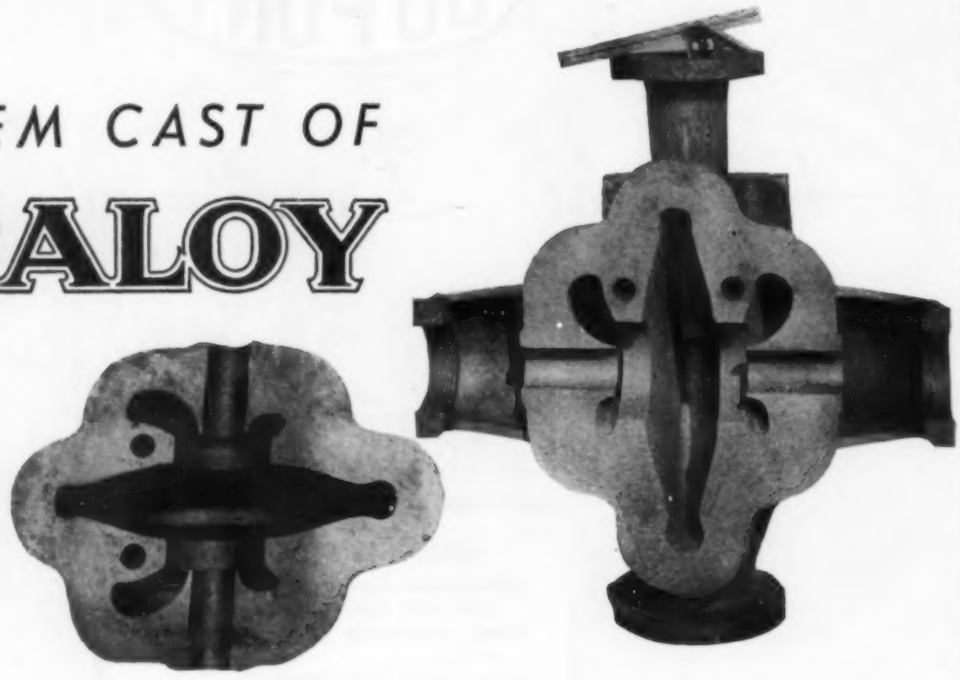
MISCELLANEOUS SERVICES

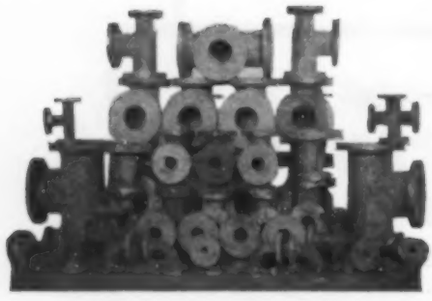
With every du Pont product is a du Pont service. Our broadly experienced technical staff is always at your service to help solve any problem involving the use of our materials. Write us. We will give any assistance you require.

E. I. DU PONT DE NEMOURS & COMPANY, INC.
AMMONIA DEPARTMENT
WILMINGTON DELAWARE

HAVE THEM CAST OF

DURALOY





Your Pumps for Handling Corrosive and Abrasive Solutions

DURALOY—the well-known Chrome-Iron or Chrome-Nickel alloys—long ago was proved to be the superior metal for pump casings, covers and impellers. The wide variations permissible in the Cr, Fe and Ni content enable us to make a casting that best meets each particular corrosion and abrasion problem. The same advantages apply to pipe, valves and fittings such as shown at the left.

The Duraloy Company has fifteen years' experience in casting these alloys. We have a modern alloy foundry throughout with the latest type electric furnaces and control instruments. We have facilities for heat-treating and for rough or finish machining.

The Chrome-Iron and Chrome-Nickel alloys, when cast by experienced foundrymen, provide very durable parts for pumps. The user benefits by getting more service. The manufacturer of the pump benefits by getting a more satisfied customer.

• • • • •

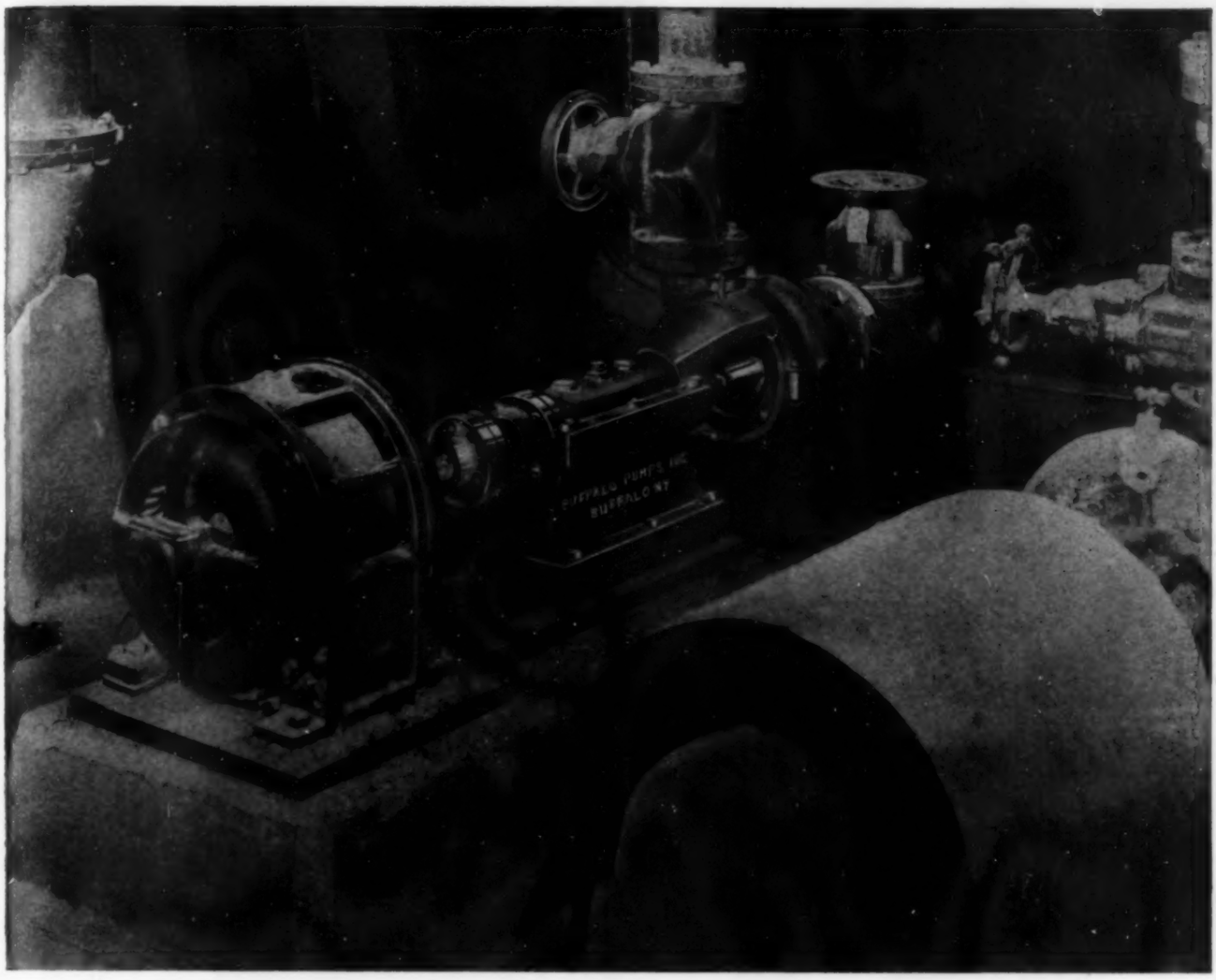
The Duraloy Company is also one of the pioneers in the manufacture of centrifugal castings which have numerous advantages over sand castings. A descriptive bulletin is available.

Other Duraloy products include sand castings of all kinds; forged shapes, sheets, tubes, nuts, bolts, etc.

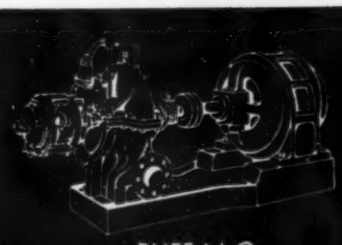
THE DURALOY COMPANY

PITTSBURGH, PA.

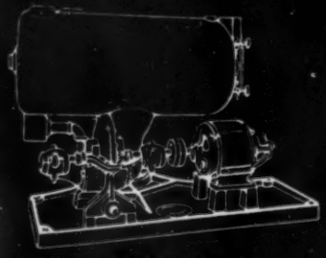
NEW YORK PLANT, NEW CUMBERLAND, W. VA. CLEVELAND



"Built-in" rigidity is a feature of this economical efficient Buffalo Pump



BUFFALO
Double Suction
Self-Priming Pumps



BUFFALO
Automatic Condensate
Pumps and Receivers

from ANY metal— for ANY liquid!

Formula for a perfect chemical plant pump: The metal which your experience tells you is best for the liquid you are pumping—plus the design found only in Buffalo Double Ball Bearing Single Suction Pumps.

Combine these two carefully, finish accurately—and put to work immediately.

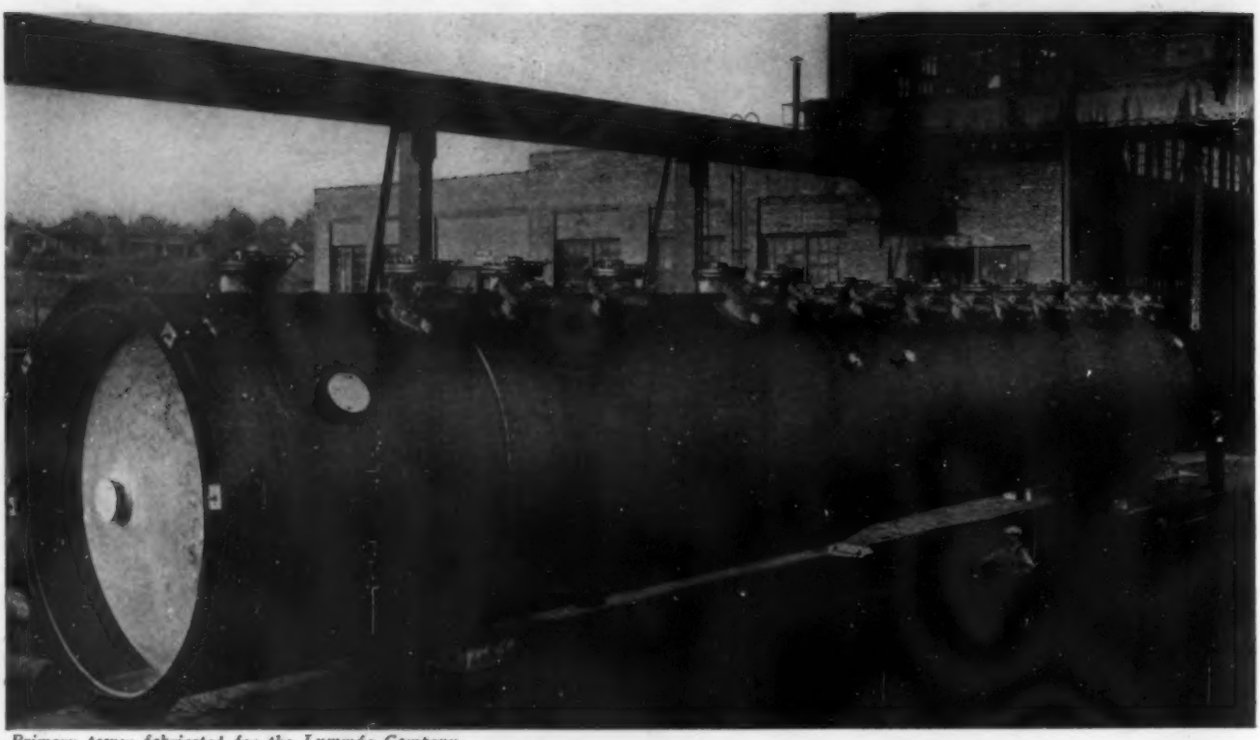
Then you'll get real performance—on ANY liquid!

BUFFALO PUMPS, INC.

501 Broadway, Buffalo, N. Y.

In Canada: Canada Pumps, Ltd., Kitchener, Ont.

"Buffalo" Double Ball Bearing Single Suction Pumps



Primary tower fabricated for the Lummus Company. 11' and 10' dia. x 54' long. Wt. 190,000 lb.

Autoclaves	Digesters
Chlorinators	Diffusers
Coolers	Dryers
Columns	Tanks
Condensers	Cylinders
Towers	Stills
Dissolvers	Separators
Kettles	Accumulators
Pots	Extractors
Retorts	Crystallizers
Scrubbers	Evaporators
Converters	Flash Chambers

Welded or Riveted

FABRICATED TO YOUR ORDER

"Fusion-Welded by CE"

The established practice in the fabrication of pressure vessels is fusion-welding. In the CE shops complete facilities assure the proper execution of orders on standard types of vessels or work involving special problems.

CE equipment for the X-raying and stress-relieving of welded vessels is of the latest design. Annealing furnaces are designed to secure the maximum degree of temperature control. All our welders are qualified Class 1. Chemical, physical and metallurgical laboratories assure a thorough check on all fabricating operations.

In addition to fabricating pressure vessels, CE shops are equipped to produce all classes of fabricated plate work.

When considering your next requirements, why not specify; *"Fusion-welded by CE?"*

MANUFACTURING DIVISIONS PRODUCING PRESSURE VESSELS AND FABRICATED PLATE WORK
THE HEDGES-WALSH-WEIDNER COMPANY, CHATTANOOGA, TENN.
HEINE BOILER COMPANY, ST. LOUIS, MO.

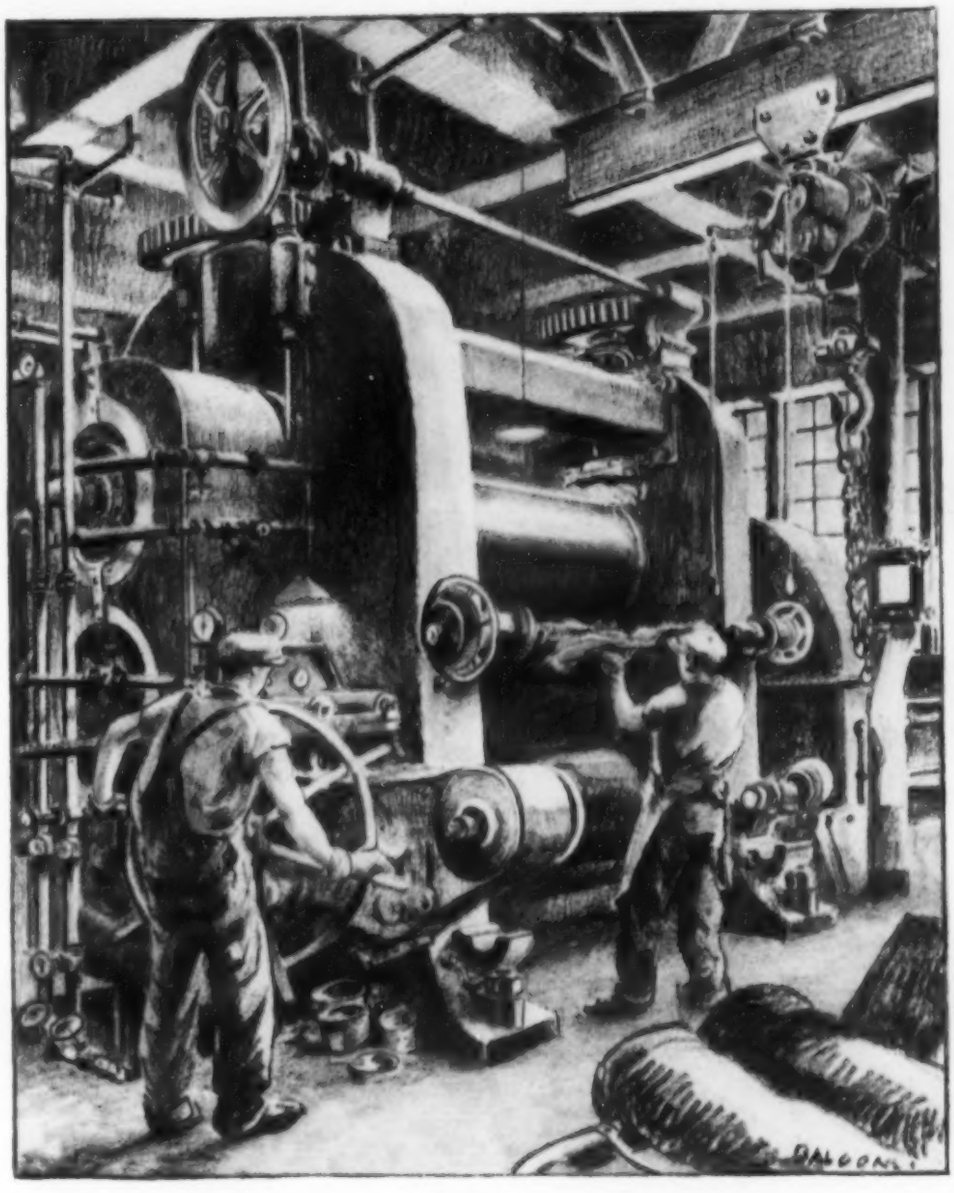
A-316

COMBUSTION ENGINEERING COMPANY, INC.

200 Madison Avenue, New York, N. Y. Canadian Associates, Combustion Engineering Corporation, Ltd., Montreal

ALL TYPES OF BOILERS, STOKERS, PULVERIZED FUEL SYSTEMS AND HEAT RECOVERY EQUIPMENT

CATALYSTS OF BUSINESS



● Chemicals are the catalysts of modern industry. Their speeding-up action is being felt in nearly every field of enterprise—through products of better quality which are easier to make yet cost less to produce. As one of the largest and most progressive manufacturers of chemicals in the country, American Cyanamid offers you many advantages which you will find stimulating to action in your business . . . wide and productive research activity, the cooperation of a large and highly skilled technical staff, quick service from centrally located plants and warehouses, the satisfaction of knowing that all your chemical needs can be met promptly from one source of supply.

Above is a scene in the rubber industry, where Cyanamid service is steadily acting as an efficient "catalyst" of progress.

American Cyanamid & Chemical Corporation

30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

(over)

SULPHUR

ACCELERATORS

Diphenylguanidine
Diorthotolylguanidine
Accelerator 49

CHEMICALS

Acids, Alkalis, Antimony Sulphurette, Carbon Tetrachloride, Cresylic Acid, Magnesium Oxide, Carbon Bisulphide

PIGMENTS

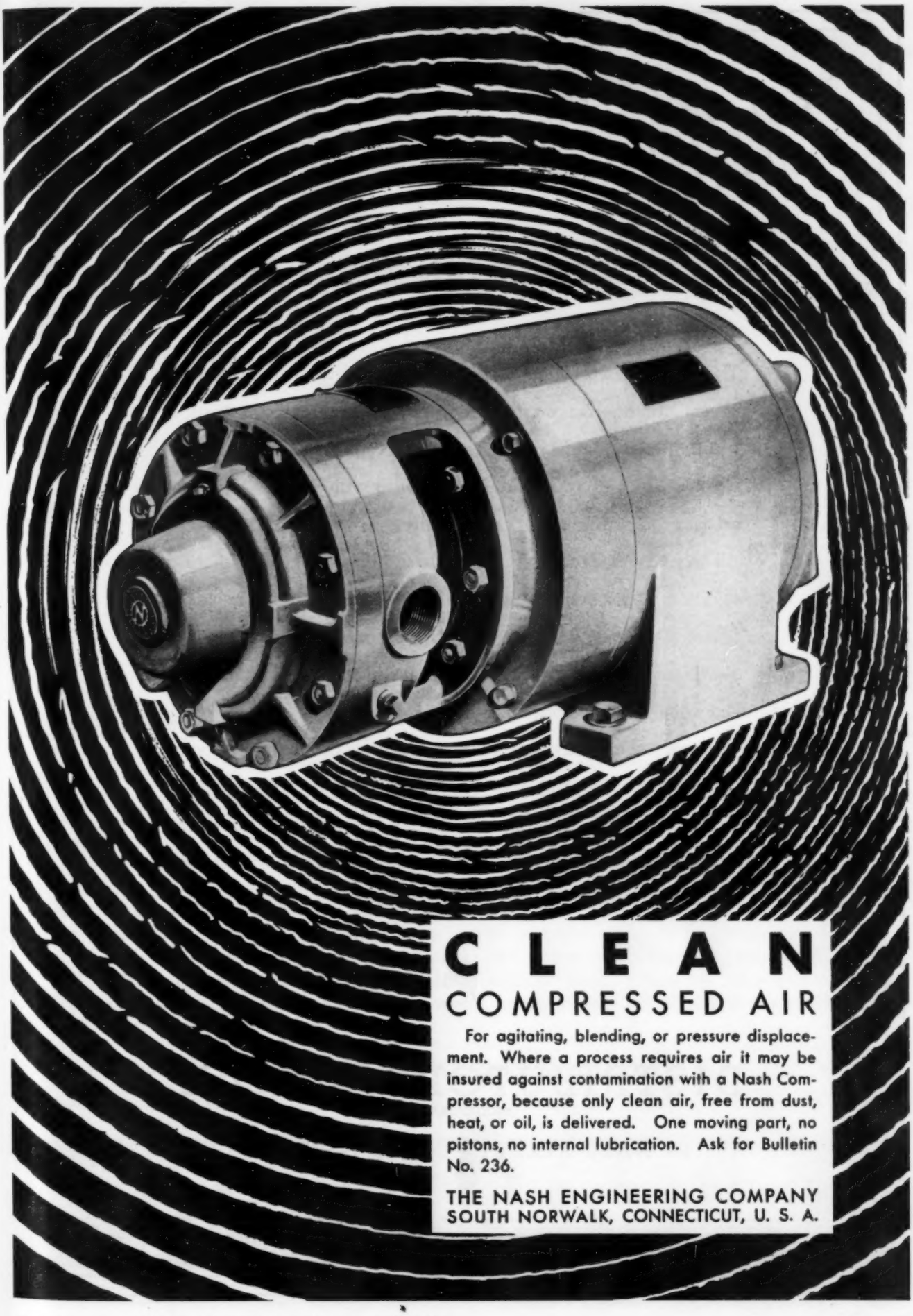
Barytes
Hydro Carbon
Soap Tree Bark
Terra Alba Clay
Factice
Zinc Oxide
Clay "L"
Burgundy Pitch
Blanc Fixe
Iron Oxide
Mica (Jasperine)
Wood Flour
Talc-Clay
Pigment Colors
Indian Red
Talc

COMPOUNDING INGREDIENTS

AMERICAN CYANAMID & CHEMICAL CORPORATION

30 ROCKEFELLER PLAZA • NEW YORK, N. Y.

(over)



CLEAN
COMPRESSED AIR

For agitating, blending, or pressure displacement. Where a process requires air it may be insured against contamination with a Nash Compressor, because only clean air, free from dust, heat, or oil, is delivered. One moving part, no pistons, no internal lubrication. Ask for Bulletin No. 236.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.

Right Hand

of the Chemical Industry

The swift growth of small companies into world-wide enterprises has been a notable feature of the chemical industry. In this development, Finance has served as a strong ally to Science, by providing the capital with which to take prompt advantage of industrial opportunity.

Distributors Group offers unique facilities for the marketing of common stocks, preferred stocks and bonds on a national scale. Our organization has taken special interest in the chemical industry, is familiar with its financial problems, and has developed special outlets for its securities.

Inquiries are invited from executives of chemical companies which require new capital for the expansion of their production and marketing facilities. Descriptive literature relating to our most recent offerings in this field will be forwarded on request. Our officers are available for consultation.

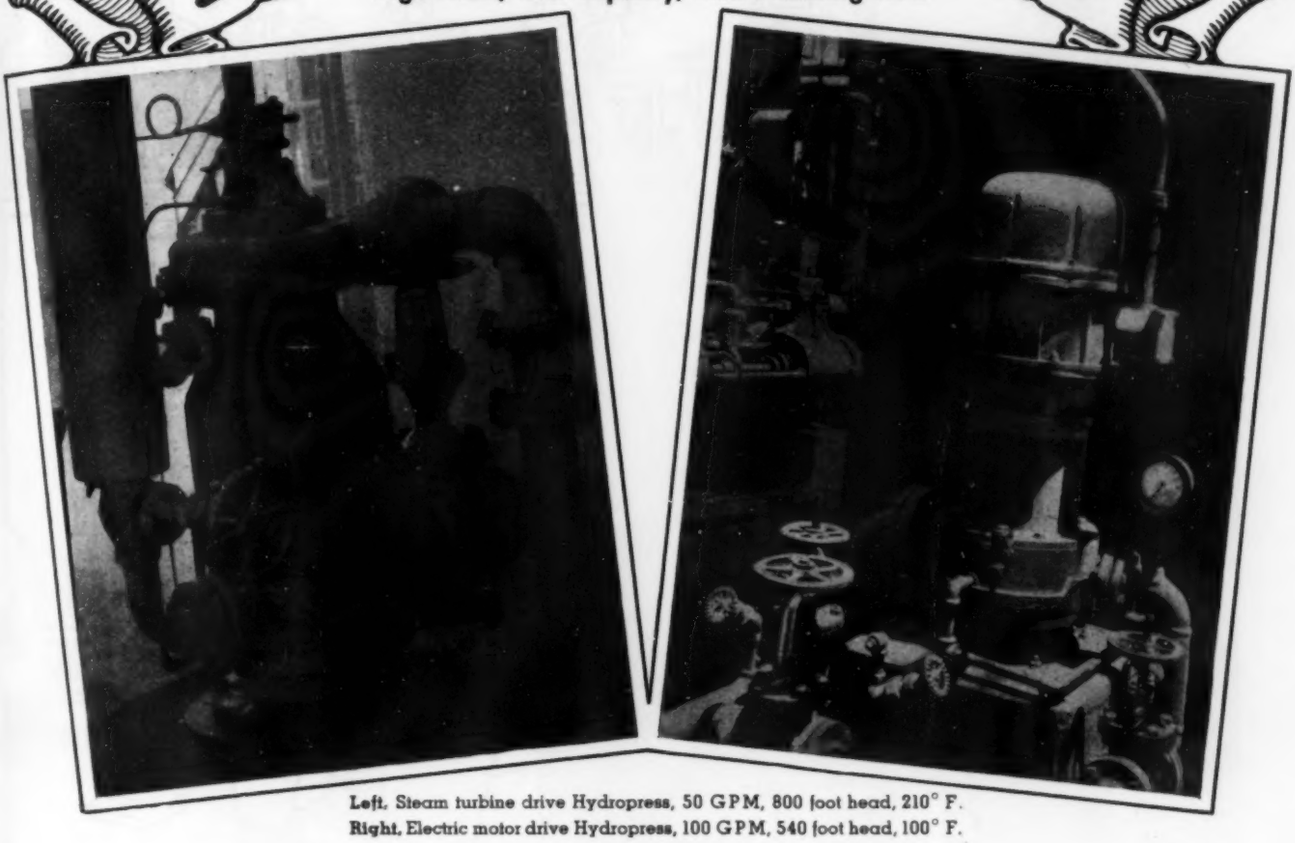
DISTRIBUTORS GROUP
INCORPORATED

63 WALL STREET NEW YORK CITY

JOHN SHERMAN MYERS, Chairman of the Board · CHASE DONALDSON, President · KENNETH S. GASTON, Vice-President

HYDROPRESS

High Head, Low Capacity, Non-Pulsating Flow



Left. Steam turbine drive Hydropress, 50 GPM, 800 foot head, 210° F.
Right. Electric motor drive Hydropress, 100 GPM, 540 foot head, 100° F.

INDUSTRY has found many uses for the Byron Jackson Hydropress, designed especially for handling all liquids where small capacity, high pressure are required. Completely automatic, it is powered either by electric motor or steam turbine. • You will find it deep underground in mines and in the highest skyscrapers. Oil refineries use it in handling oils up to 900 degrees, and at pressures exceeding 2500 pounds to the square inch. It is employed for boiler feed service, hydraulic presses, descaling of plates in steel mills, oil field repressuring, stationary spray pumps, high pressure processing, chemical solution service, and other severe applications. Write for Bulletin 357.

SINCE 1872

BYRON JACKSON CO.

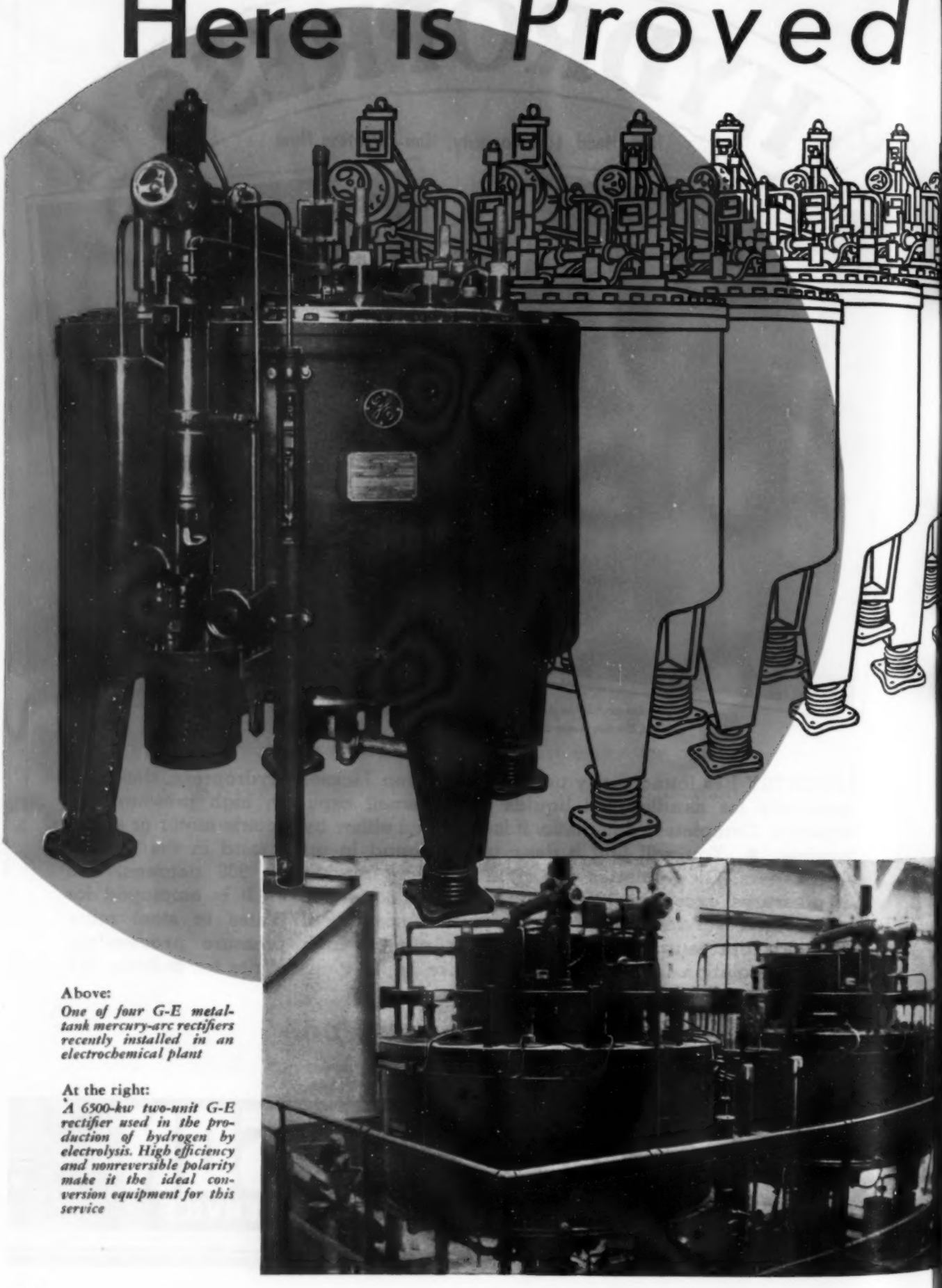
AND SUBSIDIARY

BERKELEY AND LOS ANGELES, CALIF. BETHLEHEM, PA. SALES OFFICES: NEW YORK · CHICAGO · FORT WORTH

BYRON JACKSON

CENTRIFUGAL PUMPS FOR EVERY SERVICE

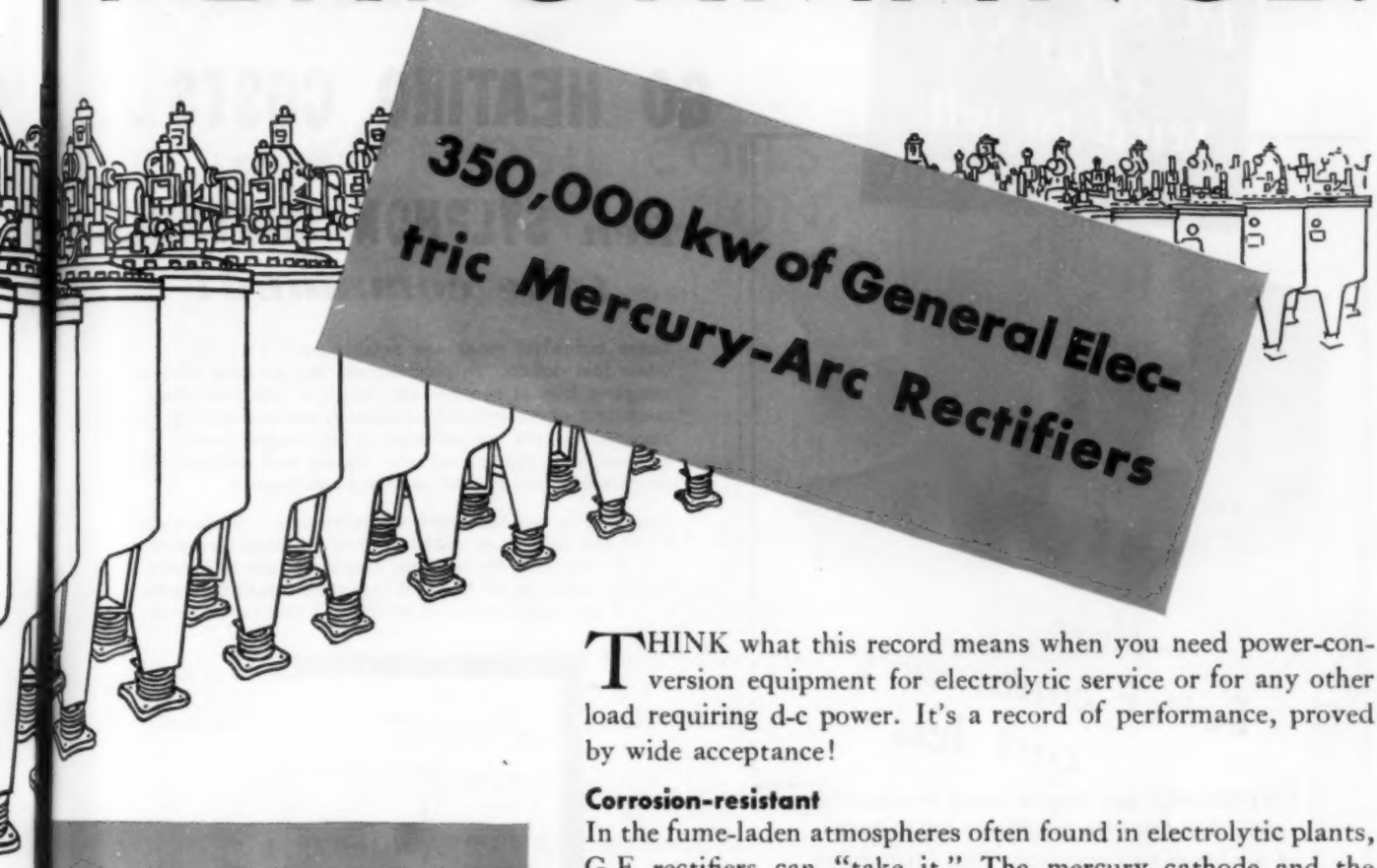
Here is *Proved*



Above:
One of four G-E metal-tank mercury-arc rectifiers recently installed in an electrochemical plant

At the right:
A 6500-kw two-unit G-E rectifier used in the production of hydrogen by electrolysis. High efficiency and nonreversible polarity make it the ideal conversion equipment for this service

PERFORMANCE!



THINK what this record means when you need power-conversion equipment for electrolytic service or for any other load requiring d-c power. It's a record of performance, proved by wide acceptance!

Corrosion-resistant

In the fume-laden atmospheres often found in electrolytic plants, G-E rectifiers can "take it." The mercury cathode and the anodes are enclosed in a highly evacuated, corrosion-resistant metal tank.

Over-all installed costs of G-E rectifiers are low. No special foundations are necessary, because of the absence of vibration and the light weight of the rectifiers. Water cooling eliminates the need for special ventilating equipment. Maintenance costs are low, and the rectifier can be operated unattended over long periods.

Reversal of D-c Polarity Impossible

Polarity is non-reversible. In some types of electrolytic work, such as the production of hydrogen by electrolysis, this feature is especially important. The efficiency of these mercury-arc rectifiers is high, especially at the higher voltages.

When you are considering mercury-arc rectifiers, think of General Electric—the leader in the number of units installed. The record of 350,000 kw in G-E rectifiers assures you of proved performance.

A Word on Synchronous Converters and Motor-Generators

Whether your power-conversion problems can best be solved by rectifier, motor-generator set, or synchronous converter, General Electric can help you solve them. Our engineers can help you select the conversion equipment exactly suited to your needs. Call the nearest G-E office. General Electric Company, Schenectady, N. Y.

280-2

GENERAL ELECTRIC

The PURCHASING AGENT tried to tell them

—that better containers cost less

EXPERIENCE has taught many purchasing agents that *price* doesn't determine the value of a shipping container. The important factors are: "How well does it do the job, and at what *net cost?*" Bemis Waterproof Bags give perfect protection to your product—and usually at a much lower cost.

Deterioration in transit or storage is stopped when you ship in Bemis Waterproof Bags. There is no sifting, odor, dust, or change in moisture content. Your product comes through in factory-perfect condition.

There is a *type* of Bemis Waterproof Bag for every industry. They provide any degree of protection required. And users profit by important savings in original cost, freight, handling, storage, and labeling.

It will cost you nothing to investigate Bemis Waterproof Bags, and it may solve your shipping problem. Write for further information on the application of these up-to-date containers to your particular industry.

BEMIS BRO. BAG CO.

415 POPLAR STREET
ST. LOUIS, MO.

5106 SECOND AVE.
BROOKLYN, N. Y.

BEMIS *Waterproof* BAGS

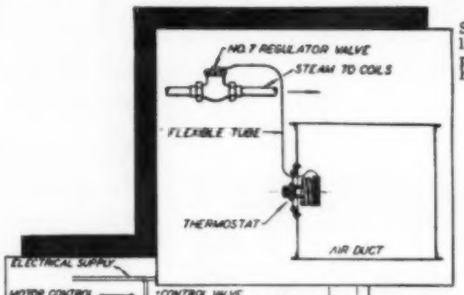
DOWN....

GO HEATING COSTS..

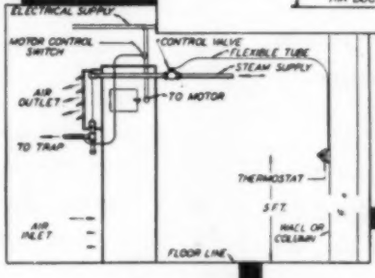
when SYLPHON CONTROLS *take command!*

Large industrial areas are notably hard to heat . . . waste fuel dollars. Sylphon solved this problem with a complete line of rugged, yet sensitive automatic regulators that provide the highly desired, *modulating* control required to hold temperatures at the comfort level . . . to save fuel, protect workers' health and products in process and storage from excessive overheating.

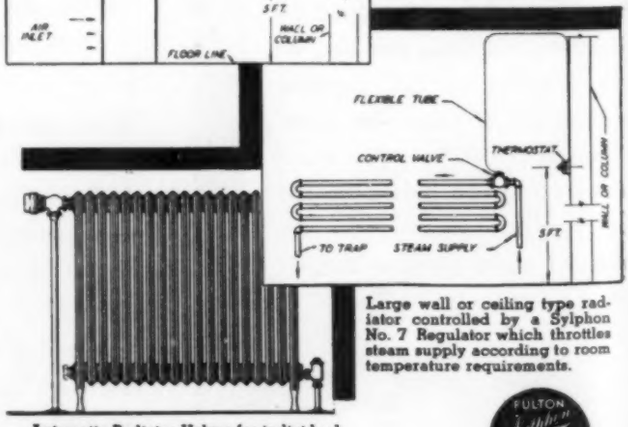
Inexpensive, self-contained, self-powered . . . these regulators are so easy to install that an ordinary steamfitter can do the job. No building alterations are necessary. Widely used on all types of industrial heating systems . . . a few applications of which are illustrated below.



Sylphon No. 7 Regulator controlling temperature of air in heating duct.



Sylphon No. 7 Regulator controlling low pressure steam supply to floor type unit heater. Thermostat switch is also shown for stopping motor when steam supply is cut off by regulator or by main supply valve. Motor starts automatically when steam is turned on.



Large wall or ceiling type radiator controlled by a Sylphon No. 7 Regulator which throttles steam supply according to room temperature requirements.

Automatic Radiator Valves for individual radiator control, throttle the steam flow to each radiator according to room temperature demands.

FULTON Sylphon FOR TEMPERATURE CONTROL

FULTON SYLPHON CO.
KNOXVILLE. TENN., U.S.A.

Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England

VITREOSIL COILS FOR IRRADIATION

Transparent Vitreosil (fused pure quartz) coils are supplied in either flat or helical form to your specifications. They are permanently transparent to ultra-violet light and offer a convenient method of irradiating liquids or gases. Their transparency to infra-red rays and the visible spectrum makes them suitable for work in these fields, while their chemical inertness to acids, corrosive gases, neutral and organic compounds is unexcelled.

Write for full particulars

The
THERMAL SYNDICATE *Ltd.*
64 Schenectady Avenue, Brooklyn, N. Y.

TEXROPE DRIVES
for every industry

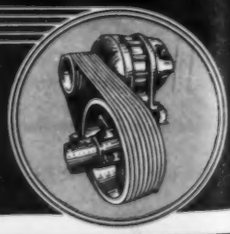
Do you want a large or small, a light or heavy, a constant or variable speed V-Belt drive? • Allis-Chalmers makes them all and not only makes them all but conceived and developed the entire multiple V-Belt principle. Also the Duro-Brace design which gives you a sheave with maximum strength and minimum weight and the Vari-Pitch design which enables you to vary your speed by making a simple adjustment. Therefore, if you want the greatest knowledge and the widest experience built into every V-Belt drive that you buy, you want Texrope V-Belt Drives built by the Allis-Chalmers Manufacturing Company. Texrope Drives are made in ranges of from ½ hp. to 2,000 hp. and in speed ratios from 1 to 1, to 10 to 1 in all popular ratings. Texrope Drives are 98.9% efficient . . . Require no belt dressing or lubrication . . . Are unaffected by moisture or dust . . . Are shock absorbing, vibrationless, slipless, silent and clean. • The Allis-Chalmers Manufacturing Company invites you to install a Texrope Drive with its guarantee of satisfaction or money back.

Write for Vari-Pitch Bulletin No. 1261

Belts by Goodrich

TEXROPE DIVISION

ALLIS-CHALMERS

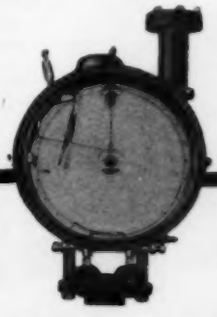


MILWAUKEE WISCONSIN

Here's the Record of alert control!

Put a magnifying glass on any Stabilog Flow Controller chart. The seemingly "compass-circle" records show continuous control. The Stabilog Controller is responding to every minute flow change. It is not suffering from a sluggish measuring system, from inertia or friction or lost motion. You'll find no dead spots, no "hunting," no periodic cycling. Each and every motion is a record of instantaneous response — resulting in smooth, close control.

Thousands of successful installations have proved that the Stabilog Controller responds with speed and accuracy to give the kind of control which insures balanced operation. Write for the Stabilog Bulletin for details.

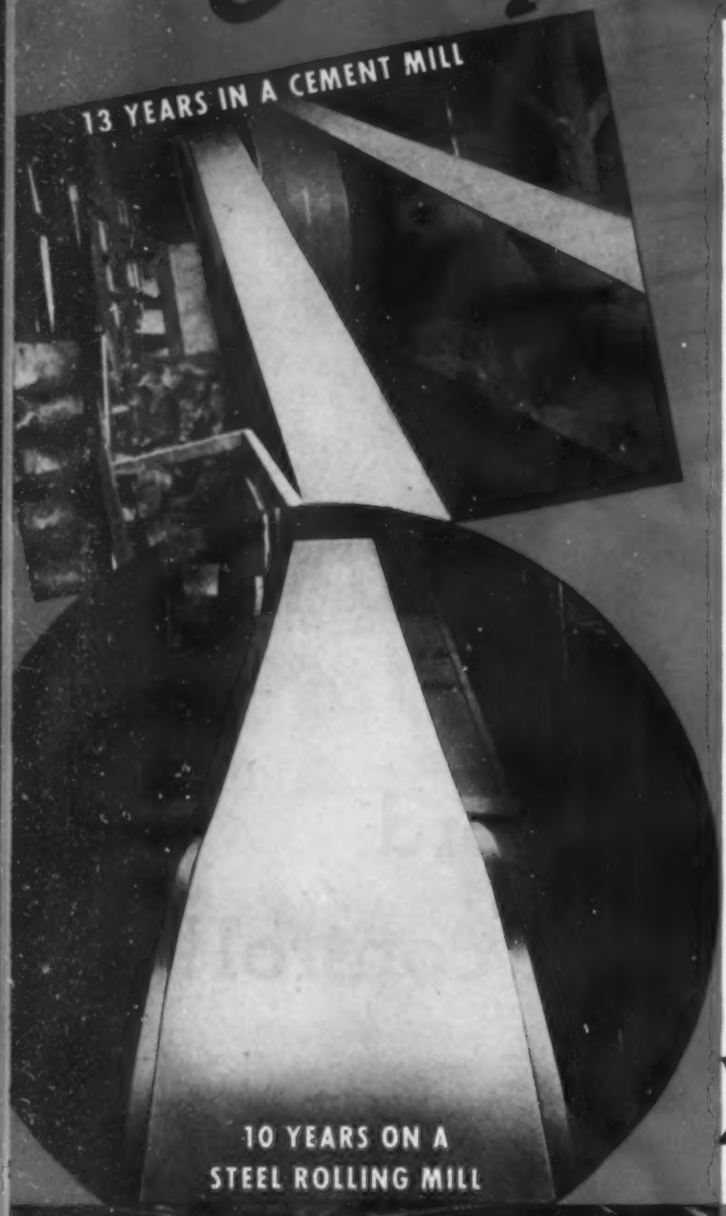


THE FOXBORO COMPANY
16 Neponset Avenue
Foxboro, Mass., U.S.A.
Branches in 25 Principal Cities

STABILOG FLOW CONTROLLER

ACCURACY FOXBORO *RESPONSE*

FIT *Every* BELT JOB WITH A



10 YEARS ON A STEEL ROLLING MILL

DRIVING 24 OIL WELLS

Made to Order

LARGE and small—odd sizes, and those easy to fit—U. S. Rubber "tailors" a belt for every type of drive.

Looking around oil fields, mills, and factories, you'll see U. S. Transmission Belts doing big and little jobs *well.* For instance... operating under severe dust conditions in a cement plant a U. S. Rainbow Transmission Belt has given perfect service for 13 years . . . this same Rainbow brand that for 40 years has been meeting requirements of every conceivable type of drive . . . unmatched for sustained performance. In a steel rolling mill 30″ 8-ply U. S. Giant Stitched Rubber Covered Transmission Belt gave 10 years' continuous service, *and was then replaced three years ago with a new U. S. Giant.* On an oil field power drive in Texas a U. S. Royal Cord Cut Edge Endless Belt 187′ 24″, 9-ply, pumps 24 wells. A cotton oil mill is replacing leather belts with 10″, 5-ply Royal Belting, which due to its unusual strength and stamina gives unusual service although practically running in a pile of cotton seed. On light machine drives there is no equal to U. S. Royal Jr.... a light, flexible, and elastic belt which permits the use of thick belts for the narrow widths customary to such transmission service, especially when frequent shifting is required.

Get in touch with your nearest U. S. Rubber representative. You may save *dollars* in initial cost—operating cost—replacement cost. Let him *fit your job* with the *right U. S. Transmission Belt.* Write for "An Album of Familiar Belts," containing many interesting transmission application photographs.

United States

United States Rubber Products, Inc.

OPERATING IN A PILE OF COTTON SEED

UNITED STATES U.S. ROYAL U.S. CORD RUBBER COMPANY

STATES RUBBER COMPANY ROYAL JUNIOR ROYAL JUNIOR UNITED STATES RUBBER CO

US UNITED STATES RUBBER COMPANY RAINBOW

RUBBER COMPANY "U.S." ROYAL UNITED STATES RUBBER

US UNITED STATES RUBBER COMPANY RED MAN

US UNITED STATES RUBBER COMPANY GIANT R C TRANSMISSION

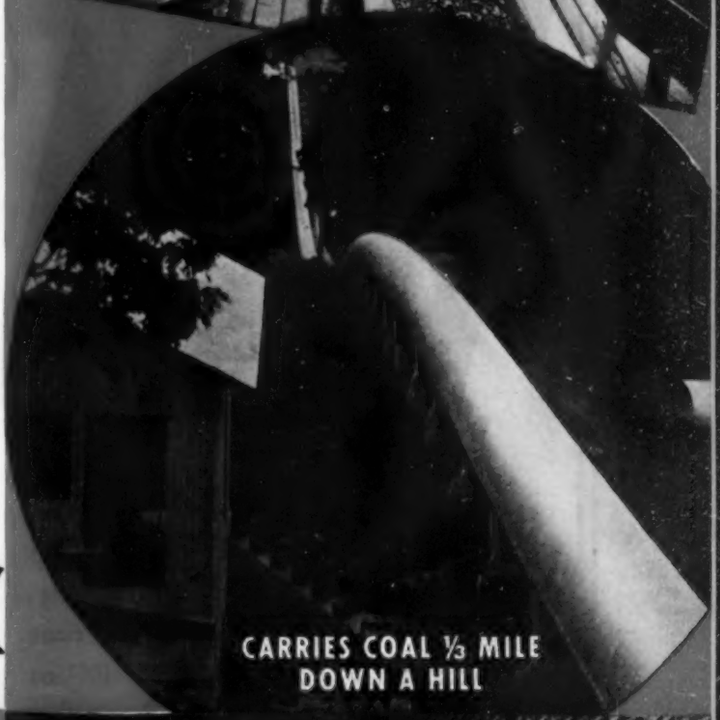
A U.S. TAILORED BELT!

Fitted to Their Loads

U.S. Conveyor Belts are also tailored to carry their loads fittingly. Go down into a mine . . . or a big excavating job . . . or walk through most any great plant . . . you'll find them hard at work.

On the Grand Coulee Dam you will see 60" U. S. Matchless Conveyor Belts which have already carried *11,000,000 cubic yards of excavation* from dam site to dump nearly *a mile away*, and almost *400 feet above the river*. On a Pennsylvania hilltop a U. S. Giant Conveyor Belt 1800 feet long lowers run-of-mine coal from the mouth of the mine to tipple. Many other U. S. Conveyor Belts underground in this mine take coal from mine face to surface. In a large limestone plant U. S. Matchless Conveyor Belts especially tailored of 42-ounce duck for exceptional strength to lift 2800 tons an hour, 147 feet, using 500 horsepower. A "whopper" of a belt! 1355 feet of 60", 10-ply U. S. Matchless Conveyor Belt especially "fitted" to do a bigger job for a western mining company. This roll of belt is 11 feet high; weight 15 tons; made under ideal conditions in the huge, well-equipped belt room of U. S. Rubber, Passaic, N. J. Specifications were checked and double checked to insure a "perfect fit" without a repair or blemish. Now in service, it's carrying approximately 20,000 tons of copper ore a day.

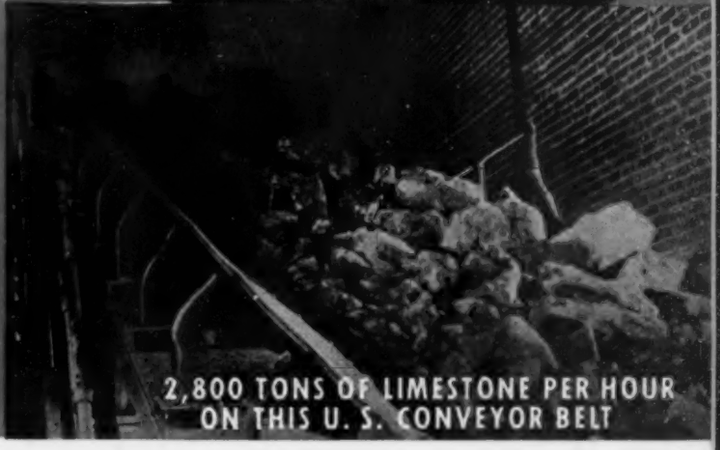
These are typical of many installations where U. S. Conveyor Belts are effecting large savings in conveying costs — and carrying their loads efficiently over long periods of time. Use them on *your* job. We will gladly send you, on request, the U. S. Conveyor Belt Album of installation photographs.



U. S. Rubber Company

1790 Broadway, New York, N. Y.

UNITED STATES RUBBER COMPANY · US · TRADE MARK



UNITED STATES RUBBER COMPANY
MATCHLESS CONVEYOR
32-OZ. P-61

UNITED STATES RUBBER COMPANY
AMAZON CONVEYOR
32-OZ. P-44

UNITED STATES RUBBER COMPANY
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BIRD
Batch
CENTRIFUGALS

The last word in suspended-basket Centrifugals, high speed, high capacity, heavy-duty, capable of cutting time and costs. . . . Furnished with 40″ or 48″ baskets, perforate or imperforate, flat bottom or self-discharging, in any machinable metals and coatings, and with manual or hydraulic unloaders, feeding and washing equipment, fume-tight construction, pre-set timers, explosion-proof motors and controls. . . . Here is the *one best* batch centrifugal. Just give us a chance to prove it. Write Bird Machine Company, South Walpole, Massachusetts.

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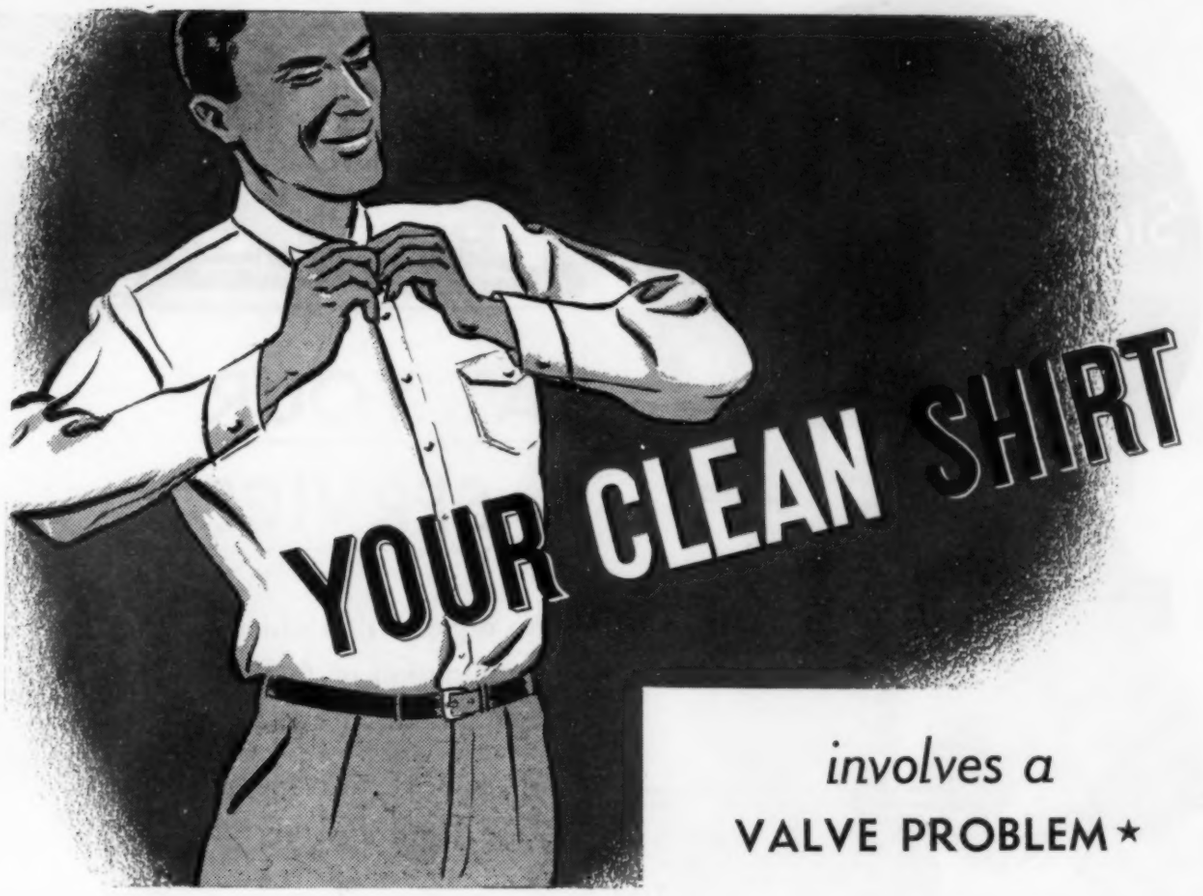
CENTRIFUGALS

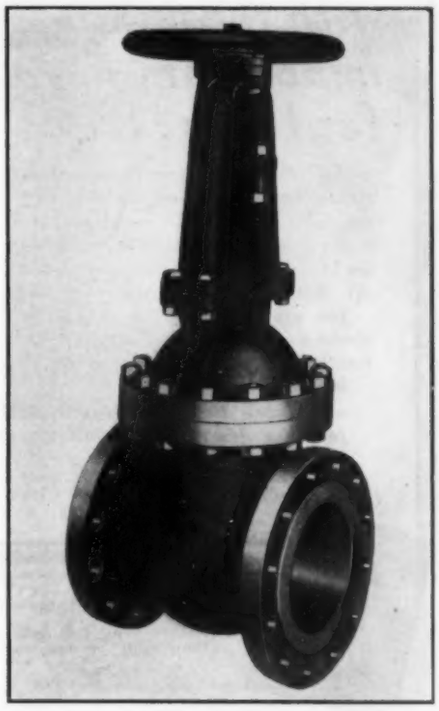
Built in two types, *filtering*, for crystalline or granular materials, and *solid bowl* for materials that do not lend themselves to filtration. . . . Bird Continuous Centrifugals bring centrifuging into line with modern, economical continuous-flow practice. . . . On a wide variety of deliquoring and clarifying jobs they are producing better results at lower cost than can be obtained by other methods. . . . Why not get the facts on Bird continuous centrifuging as applied to *your* product? Write Bird Machine Company, South Walpole, Massachusetts.



involves a
VALVE PROBLEM★

For the crisp freshness of your weekly laundry, you can thank soaps that are detergent enough to "start" and cleanse out dirt and grime . . . yet gentle in their action on the fabric.

And for valves that handle caustics, lyes and salt solutions day in and day out—yet remain spotlessly clean of any trace of corrosion—scores of soapmakers thank Chapman. For they have found Chapman Valves dependable, long-lived, all along the line. In plants where these valves are installed, processing is never held up.



★ SOLVED *by* CHAPMAN

Manufacturers of soaps and solvents bring many problems to Chapman. And Chapman solves them all with valves of special alloys for corrosive lines—with valves of iron, bronze, or cast steel for steam and water lines.

If your processing problem also requires exceptional valve performance to prevent shutdowns and high maintenance costs, you will find the valves you need in Chapman's standard line. Let's talk it over. Write today for information.

The
CHAPMAN VALVE
MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS

A new advance in Standard Iron-Body *Wedge* GATE VALVE Design

with these important features . . . .

metal 50% stronger than ordinary cast iron;
stems bronze-bushed at all contact surfaces;
special provisions to maintain stem alignment;
rust-proofed stuffing box bolts and nuts;
no studs used anywhere on valves;
all bolt heads and nuts with ample clearance for wrenches;
chain-wrench lugs on screwed-end valves;
handwheel with ample room for operator's hands;
and more than two dozen other special features described in bulletin which will be mailed on request.

THE KENNEDY VALVE MFG. CO.
ELMIRA, N. Y.

Send the Coupon for full information

The Kennedy Valve Mfg. Co., Elmira, N. Y.
Please send full information on your new Iron-Body Wedge Gate Valves.

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Company .....
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KENNEDY
STANDARD IRON-BODY *Wedge* GATE VALVES

AT YOUR SERVICE

An organization which has a combination of facilites seldom found in one plant.

Machine Shops, Plate Shops, Tank and Boiler Shops, Welding Shops, X-raying, Stress relieving and many other facilities all in one organization.

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CHESTER, PA.

BUILT TO ORDER

Pressure Vessels
Tanks—Condensers
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RAIL OR WATER SHIPMENT

THIS PROBLEM IS *Nothing New to him*

THE GULF MAN
IN THE MILL—
ACTUAL PHOTOGRAPH

In every type of plant in the chemical industries—Gulf engineers are working with operating men to improve lubrication and make machinery run better.

Gulf Lubrication Engineers Have Had Broad Experience in Plants Similar to Yours . . . .

THIS is where the Gulf engineer feels at home—out in the plant working with the men who make the wheels go 'round.

He has tackled many lubrication problems like this before—it has been his business to cooperate with plant men for years. His aim is to increase the efficiency of lubrication, to effect savings in maintenance and to improve plant production.

Many plant executives have found that this service—extended to all users of Gulf quality lubricants without cost—has helped them make savings far greater than their total bill for lubricants for a year.

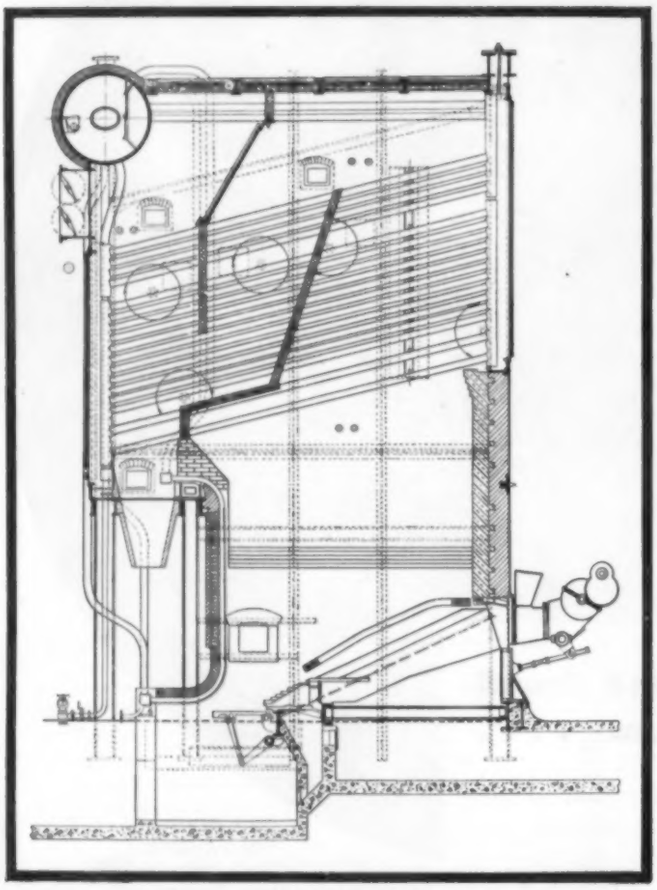
A Gulf engineer is always at your service.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION ★ GULF REFINING COMPANY

GENERAL OFFICES: GULF BUILDING, PITTSBURGH, PA.

Rx *for lowering* HIGH STEAM COSTS *in* CHEMICAL PLANTS



620 horse power Vogt Sectional Header Boiler installed in a chemical plant in Baltimore.

Prompt analysis and solution of the problem represented by this symbol (2 HI S-T-E-A-M C-O-S-T) will add to the profits of any chemical plant!

A large Eastern Chemical Company has done this. They put their steam problem up to VOGT and the modern boiler installation illustrated was recently placed in operation.

VOGT engineering service is available to help put your *low cost steam* program into effect. Say WHEN, we'll tell you HOW!

HENRY VOGT MACHINE CO.
INCORPORATED
LOUISVILLE, KENTUCKY

Vogt *forged steel* SECTIONAL HEADER BOILERS

Re-designed and Modernized Valves

Powell standard bronze and iron body gate, globe, angle, check, and Y valves have been re-designed to better withstand existing service demands. Fundamentally correct in design, they appeal to the plant engineers who want dependable performance. These re-designed and modernized valves are listed in the Powell new No. 11 catalog.

FIG. 102
BRONZE WHITE STAR GLOBE VALVE

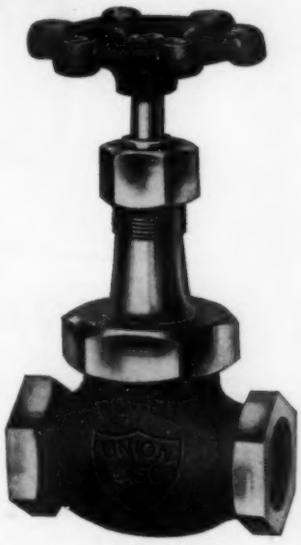


FIG. 150
BRONZE COMPOSITION DISC
GLOBE VALVE

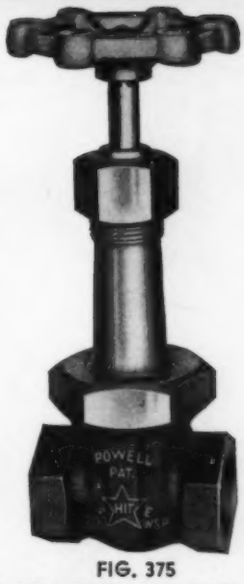


FIG. 375
BRONZE WHITE STAR GATE VALVE

FIG. 1444
IRON BODY RISING
STEM GATE VALVE

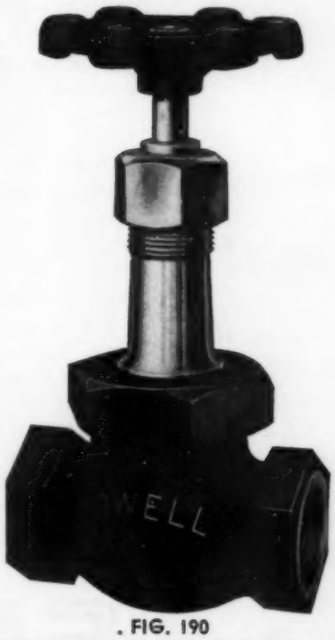


FIG. 190
IRON BODY IRENEW GLOBE VALVE

FIG. 1431
IRON BODY NON-RISING
STEM GATE VALVE

POWELL VALVES

THE WM. POWELL CO. CINCINNATI, OHIO

Above—GARLOCK 234 Coil
Left—GARLOCK 239 Rings

"Garlock 234 Is Great for Centrifugal Pumps!"

MANY times Garlock representatives in all parts of the country have heard this remark! Engineers everywhere depend on *Garlock 234 Rotopac Packing* for superior performance on rotary and centrifugal pumps. GARLOCK 234 is manufactured from long fibre asbestos, braided square and specially lubricated for service against hot or cold water, caustic solutions and weak acids.

THE GARLOCK PACKING CO.
PALMYRA, N. Y.

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GARLOCK

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—Tough Filtration Problems. Forty years' experience in every branch of industry without a failure. Finest laboratory equipment and methods available for testing and studying any filterable substance. Address: D. R. Sperry & Company, River St., Batavia, Ill.

Leading manufacturers the country over can testify that it pays to talk to Sperry when filtration questions arise. No matter how complex or difficult the problem may be, Sperry has the knowledge, the experience, and the laboratory facilities to properly examine and check on your materials, determine their filtration ability, and design and produce the right filter press or presses to do the job with maximum efficiency and economy. In many cases Sperry has recommended new methods and presses that reduced filtration costs far below the manufacturer's most optimistic hopes.

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Two completely equipped laboratories are maintained—one in Batavia, the other in New York—with teletype machines for instant intercommunication. Avail yourself of Sperry service, without obligation, and be sure your filtration problems are solved to best advantage.

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FILTER PRESSES

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FILTRATION ENGINEERS FOR 40 YEARS

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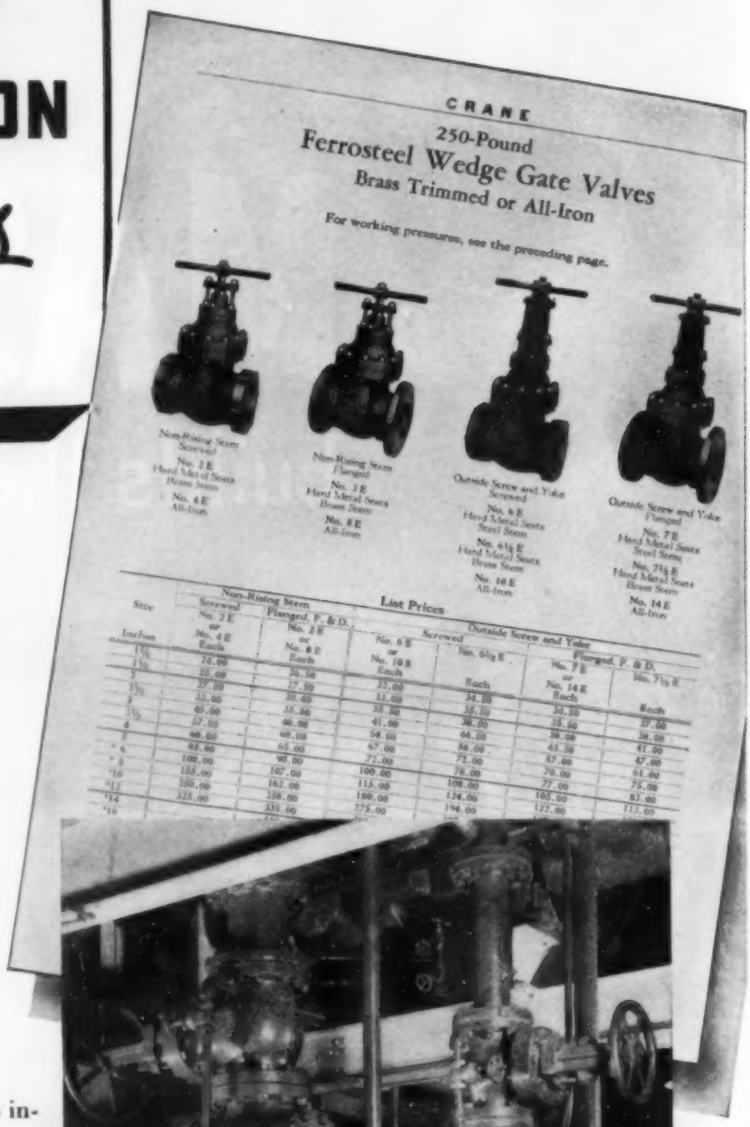
STRONGER THAN CAST IRON ...Costs Less THAN STEEL


CRANE

250-Pound

Ferrosteel Wedge Gate Valves

Brass Trimmed or All-Iron

For working pressures, see the preceding page.

Non-Rising Stem Screwed — No. 2 E Hard Metal Seats Brass Stem — No. 4 E All-Iron

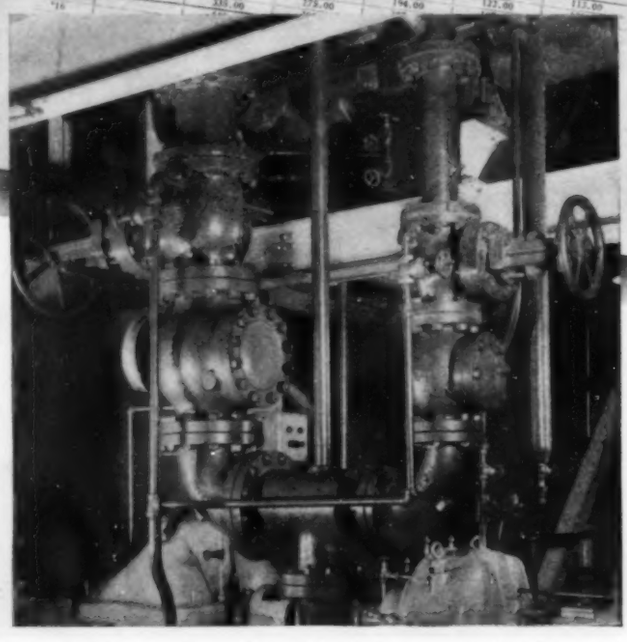
Non-Rising Stem Flanged — No. 3 E Hard Metal Seats Brass Stem — No. 8 E All-Iron

Outside Screw and Yoke Screwed — No. 6 E Hard Metal Seats Steel Stem — No. 6½ E Hard Metal Seats Brass Stem — No. 10 E All-Iron

Outside Screw and Yoke Flanged — No. 7 E Hard Metal Seats Steel Stem — No. 7½ E Hard Metal Seats Brass Stem — No. 14 E All-Iron

List Prices

Size	Non-Rising Stem Screwed No. 2 E or No. 4 E Each	Non-Rising Stem Flanged, F. & D. No. 3 E or No. 8 E Each	Outside Screw and Yoke Screwed No. 6 E or No. 10 E Each	Outside Screw and Yoke Screwed No. 6½ E Each	Outside Screw and Yoke Flanged, F. & D. No. 7 E or No. 14 E Each	Outside Screw and Yoke Flanged, F. & D. No. 7½ E Each
Inches						
⅛	20.00					
¼	20.00	20.50				
⅜	27.00	27.50	32.00	34.00	34.00	37.00
½	33.00	30.00	32.00	34.00	34.00	37.00
¾	40.00	35.00	38.00	38.00	38.00	41.00
1	47.00	40.00	41.00	38.00	38.00	41.00
1¼	60.00	60.00	54.00	64.00	58.00	61.00
1½	65.00	65.00	67.00	58.00	61.00	64.00
2	100.00	90.00	71.00	73.00	67.00	67.00
2½	135.00	107.00	100.00	78.00	78.00	61.00
3	150.00	162.00	115.00	108.00	77.00	75.00
4	225.00	258.00	160.00	134.00	105.00	83.00
5		335.00	275.00	194.00	123.00	112.00



Crane 7-E Extra Heavy Gate Valve in fire-pump service. This and similar valves described on page 83 of the new Crane No. 52 Catalog

● The bodies and bonnets of Crane 250-Pound No. 7-E Wedge Gate Valves are made of Crane Ferrosteel, a high grade iron having a tensile strength approximately 35 per cent greater than that of ordinary cast iron. The use of this tough metal, ample sections and correct proportioning make Crane No. 7-E Wedge Gate Valves exceptionally strong and rigid.

They are suited for a wide range of services in chemical and metallurgical plants where valves are required that are more rugged and which have a higher factor of safety than usual cast-iron body valves. They give excellent results on steam lines up to 250 pounds at 550 degrees F., on high-pressure cold water, air, oil, gas, and other services which are not corrosive to either iron or brass.

All working parts are made extra strong to insure long life. Valve seats and discs are made of Crane Hard Metal to resist wear, wiredrawing and corrosion. Only minimum maintenance is required and repacking can be done easily and quickly.

The Crane line of valves, fittings and fabricated piping is complete. Crane Co. is also in a position to supply valves of special metals to meet unusual corrosion problems. A Crane branch or distributor is in your city, ready to serve you.

Let Profits Pay for Plant Improvements. Use the Crane Finance Plan.

CRANE

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Branches and Sales Offices in One Hundred and Sixty Cities

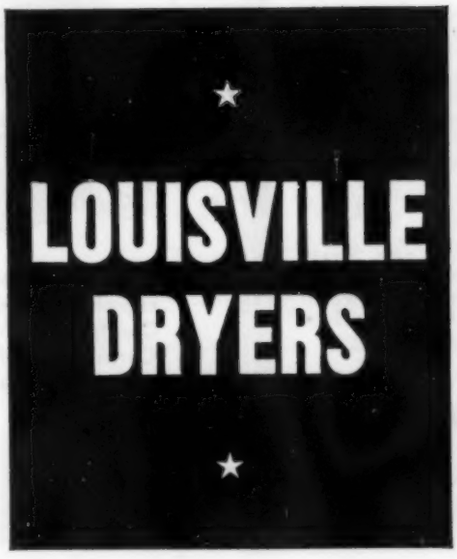
VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

HAVE YOU SENT US YOUR FIGURES?

Because our advanced type of analysis and engineering produces surprising economies in the drying process—

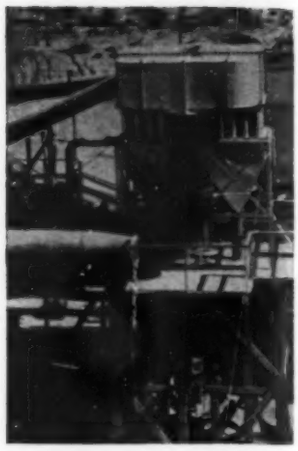
—because we can tell you in advance whether or not (and how much) a Louisville Dryer can save on your drying operation—

—this company again invites you to let us check your present drying costs against the guaranteed results that can be achieved with a Louisville Dryer.

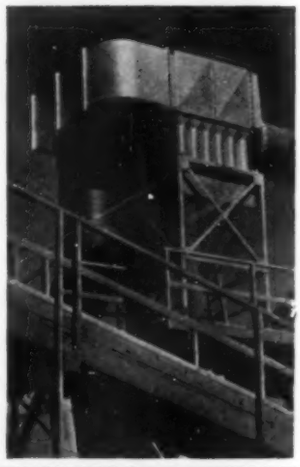


This work will be done without cost to you. It merely requires that you answer a few questions about your plant and product, and send us both wet and dry samples. Write today for our Questionnaire Sheet. *Address:* Louisville Drying Machinery Company, *Incorporated,* 451 Baxter Avenue, Louisville, Kentucky.

Dust



A nuisance or a product? In either case Multiclone collection combines low cost operation with high efficiency and simplicity. A dry process of intensified centrifugal separation and collection, with no parts to clean, repair or replace. Multiple tube construction permits installations of any capacity and easy additions when expansion is needed. All-metal, fireproof, to handle hot or cold gases. Multiclones collect finer particles than any other centrifugal type of separator. Can be erected by regular factory help.



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PRECIPITATION CO. OF CANADA, LTD., Dominion Square Bldg., Montreal

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Specialists in Dust and Fume Control for more than a quarter of a century

MONARCH
non-clogging
SPRAY NOZZLES

For Air Washing

We recommend either ⅜" Fig. 629 male pipe (illustrated) or ¼" Fig. 631 (female) Brass nozzles. Small, efficient, and inexpensive, they produce an evenly distributed hollow cone spray. One large lead hole minimizes any clogging tendency. Capacities from 4.7 G.P.H. up at 40 lbs.

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Monarch Fig. B-8 and new B-8-A cast Brass nozzles, for cooling condensing water in spray ponds, use no internal vanes or deflectors which might facilitate clogging. Available in capacities up to 76.5 G.P.M. at 10 lbs.

Write for New Catalog 6-A

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Cork Insulation Company's trained engineers supervise and direct all operations. Corinco Corkboard, Corinco Cork Pipe Covering and Corinco Cork Machinery Isolation are installed swiftly, economically and permanently.

Write for information

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MANUFACTURERS OF CORINCO SHEET CORK • CORINCO GRANULATED CORK • CORINCO CORK PIPE COVERING

Here is a story of interest to every chemical plant superintendent

. . . The job was so murky with corrosive fumes we couldn't take a clear picture

● At one Detroit plant two 62-foot lengths of ½" "KORōDLESS" rope (used on crane) are giving wonderfully fine service.

The operation is that of pickling and cleaning sheets subsequently to be stamped into automobile body parts.

The crane picks up a 4000-pound load of sheets, evenly spaced in a cradle to allow circulation of the pickling liquids. After these sheets are let down in a washing solution they are immersed in a solution of hot acid where they remain for 10 minutes. They are then removed and allowed to drip fairly dry. The next operation is immersion in a mild acid solution, then finally to a clean water bath.

Throughout these several operations "KORōDLESS" wire rope is enduring the same bath immersions.

Prior to using Hazard Preformed "KORōDLESS" wire rope they were unable to get more than 10 days' service from any rope used. Now, with "KORōDLESS" they are consistently getting nine months' service. "KORōDLESS" ropes are discarded now only because of mechanical actions, and here, too, they are giving a splendid account of themselves.

This isn't such an exceptional case of "KORōDLESS" durability as you might think. That 18/8 stainless steel of which "KORōDLESS" is made can be a blessing to chemical plant engineers. Write for a sample and full information.

HAZARD WIRE ROPE COMPANY
WILKES-BARRE, PENNSYLVANIA
An Associate Company of the American Chain Company, Inc.
In Business for Your Safety
District Offices: New York • Chicago • Philadelphia • Pittsburgh • Fort Worth
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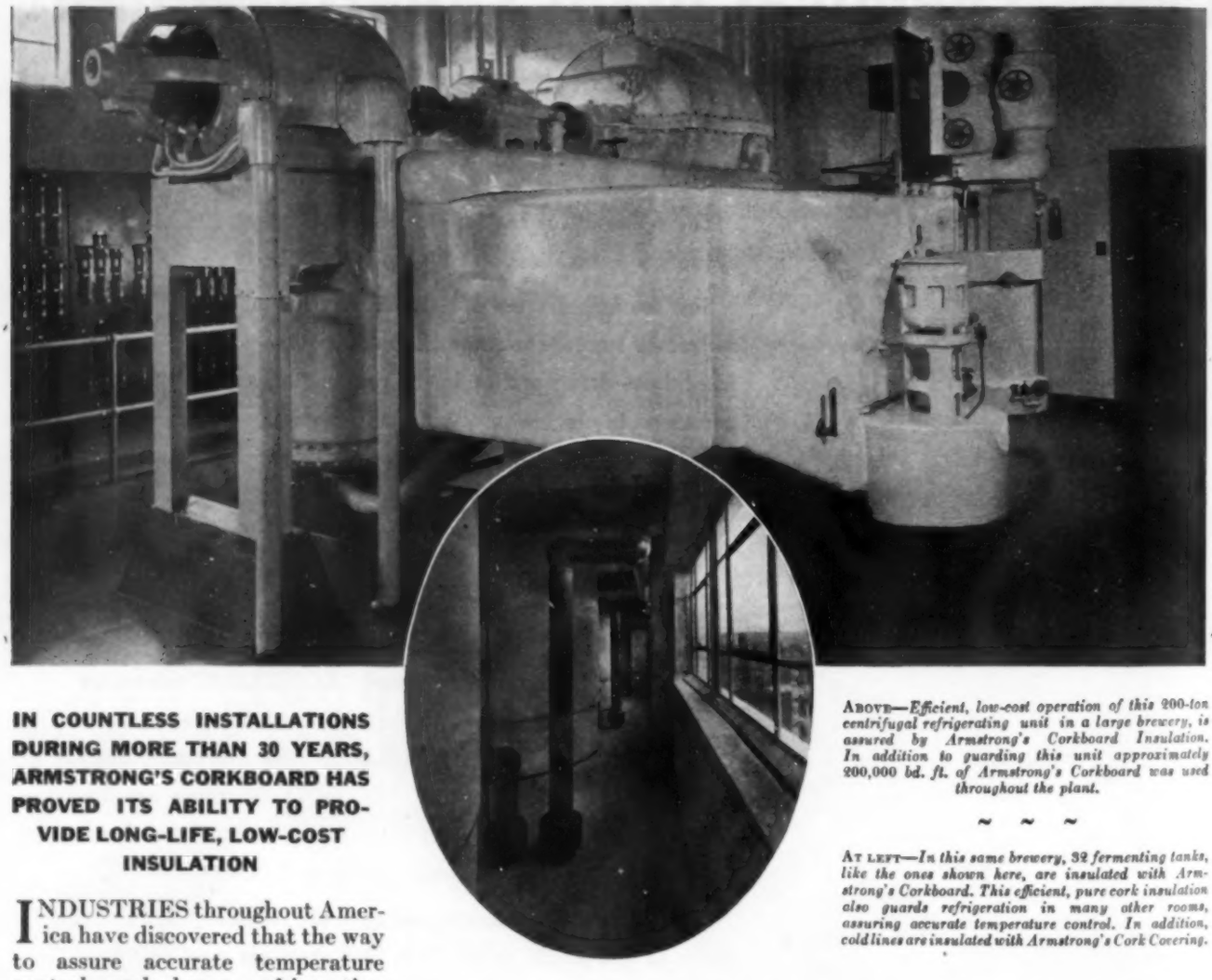
CORK IS INDUSTRY'S CHOICE FOR *permanent* INSULATING EFFICIENCY



IN COUNTLESS INSTALLATIONS DURING MORE THAN 30 YEARS, ARMSTRONG'S CORKBOARD HAS PROVED ITS ABILITY TO PROVIDE LONG-LIFE, LOW-COST INSULATION

INDUSTRIES throughout America have discovered that the way to assure accurate temperature control and lower refrigeration costs, is through the use of Armstrong's Corkboard. And they have proved conclusively that Armstrong's Corkboard Insulation is *permanent* insulation. Many installations of this dependable material made fifteen, twenty, and even thirty years ago, are still serving faithfully.

This outstanding service record is the result of the unique physical properties of cork itself. Because of its natural cell structure, cork possesses *low* thermal conductivity and *high* moisture resistance . . . qualities that are fully retained in Armstrong's Corkboard. This dependable material not only retards the passage of heat—effectively and permanently—but also resists the damaging effects of moisture encountered in all low temperature work.

Equally efficient as an insulation for cold lines, is Armstrong's Cork Covering. Sections are accurately molded to fit pipes or fittings. And for added protection, the inside of each section is carefully machined to assure a snug fit and eliminate moisture-catching air pockets.

Armstrong engineers will be glad to work with you in planning any type of insulation work. Write today for full information, samples, and prices of Armstrong's Corkboard and Cork Covering. Armstrong Cork Products Company, Building Materials Division, 919 Concord Street, Lancaster, Pennsylvania.

ABOVE—*Efficient, low-cost operation of this 200-ton centrifugal refrigerating unit in a large brewery, is assured by Armstrong's Corkboard Insulation. In addition to guarding this unit approximately 200,000 bd. ft. of Armstrong's Corkboard was used throughout the plant.*

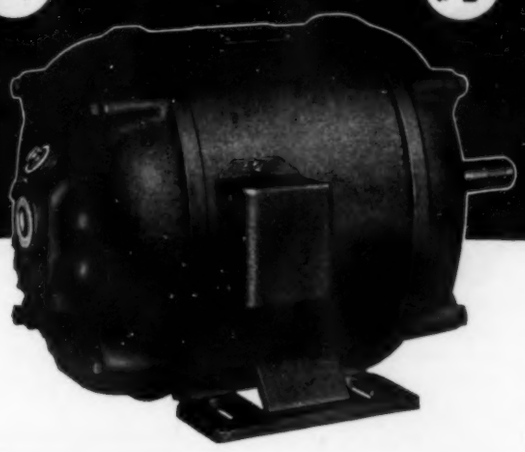
~ ~ ~

AT LEFT—*In this same brewery, 32 fermenting tanks, like the ones shown here, are insulated with Armstrong's Corkboard. This efficient, pure cork insulation also guards refrigeration in many other rooms, assuring accurate temperature control. In addition, cold lines are insulated with Armstrong's Cork Covering.*

Armstrong's **CORKBOARD**

INDUSTRIAL
Fractional Horse Power
POLYPHASE MOTORS

1/6 1/4 1/3 1/2 3/4



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Definitely designed and built to meet the most rigid *industrial* requirements and the exacting demands of heavy-duty continuous precision production—these fractional horse power Century Polyphase Motors fully measure up to every performance requirement of the tools and equipment they drive.

Quiet starting—Quiet running—Remarkable freedom from vibration—Harmonizing appearance—Built throughout to precision standards.

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SELECT A PACKING SUITED TO THE CONDITIONS OF SERVICE

No One Packing Can Meet All Conditions.

Avoid Scored Rods and Leaky Stuffing Boxes.

For Steam (Superheated) and Compressed Air.
Only Highest-Grade Asbestos Used. Lubricated in Each Single Strand.

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Made of High-Tensile-Strength Cotton, not affected by Feed-Water Compounds.

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Its Lubricant Resists the Action of the Above Fluids, and Prevents Scoring of Shafts.

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● ... NO "DEAD" AREAS
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LINK-BELT *VIBRATING* SCREEN

● The Link-Belt Vibrating Screen has proved its effectiveness in the screening of all sorts of materials, such as sand, gravel, crushed stone, coal, coke, clay, fertilizer, lime, ore, grain, sugar, chemicals, pulpwood chips, etc. Its uniform vibration keeps the meshes open, and makes the screen's entire screening surface 100% effective.

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FILTERS FOR MINERAL, TASTE, COLOR, ODOR REMOVAL
LIME AND SODA SOFTENERS
ZEOLITE SOFTENERS
IRON REMOVAL PLANTS
STERILIZERS

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● Tanks and fittings shop assembled or erected on the job.
● For real utility, ease of maintenance and long life, use Graver Tanks and supplemental equipment.

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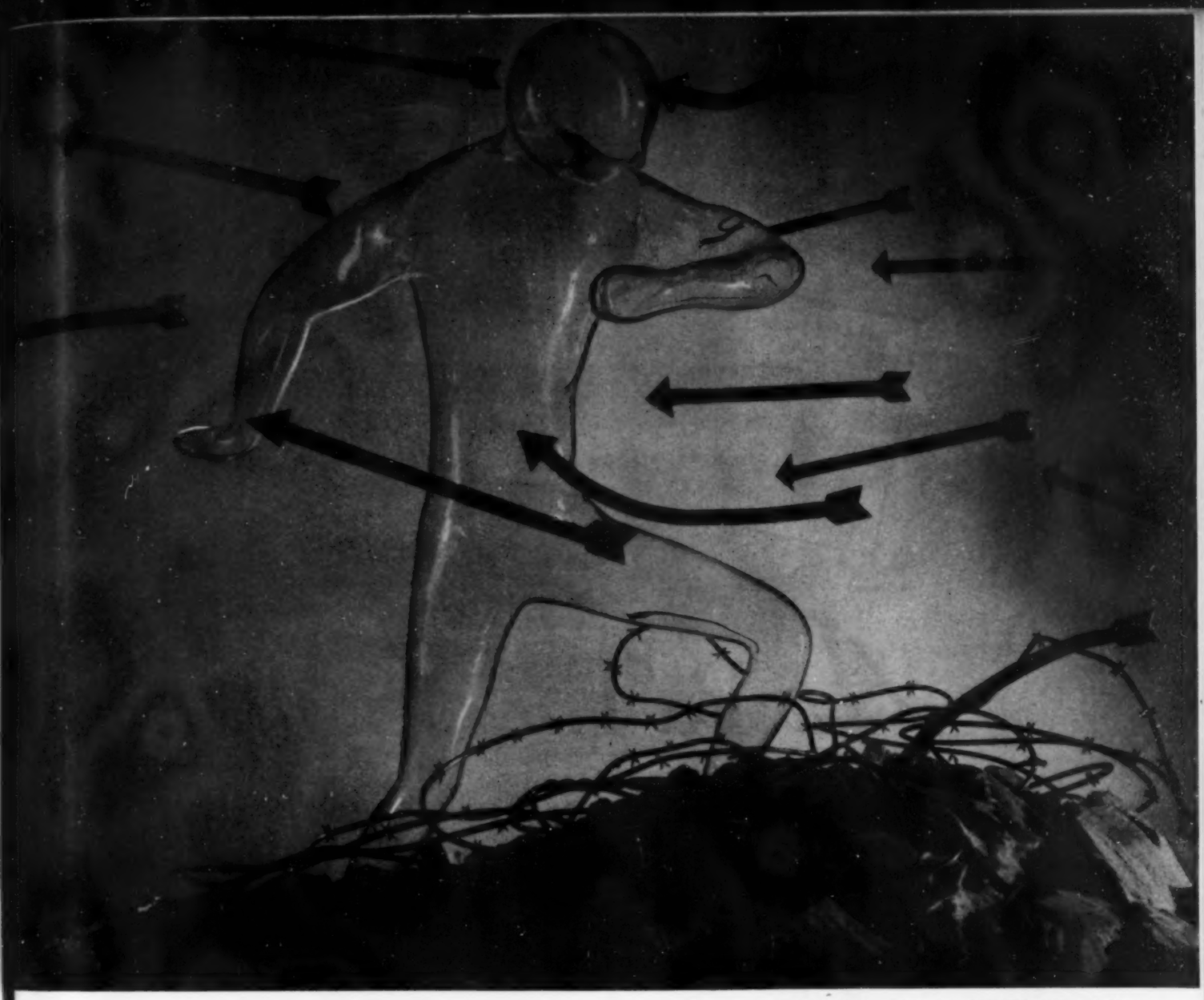


The above figure is made of "PYREX" Brand Glass —evidence of the adaptability to various special shapes.

HARDNESS...*resists* ABRASIVE ACTION

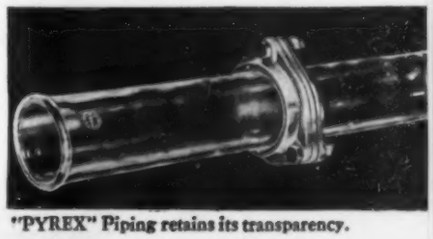
Hardness is only one of the many advantageous characteristics of "PYREX" Brand Glass. But it is often the reason why—for certain purposes—this durable glass is the *only* material which can be used.

Because of its hardness (only two points below the diamond on the Moh's hardness scale) "PYREX" Piping has a remarkable resistance to abrasion. Consequently you can depend upon "PYREX" Piping to:

1. Retain its crystal clear transparency.
2. Remain free from scratches and pits.
3. Permit a steady, even flow of liquids.
4. Be easily cleaned.
5. Protect the purity of your product.

Wherever the combined features of chemical and mechanical durability, visibility, resistance to thermal shock and economy are essentials, use "PYREX" Piping. The experience of Corning Engineers is yours for the asking. Write for details.

"PYREX" Heat Exchangers, because of their hard, smooth surfaces give a long life of uniformly efficient service.



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An R.T.A.S. *man*

will dig into your corrosion-resistance problem*

"Each application of corrosion-resistant metals presents an individual problem. We can make no blanket recommendation as best for all conditions of service. We can and do maintain a staff of *Technical Advisers*, who are available for consultation. It is the duty of these men to study the problems presented by each individual application and to assist the manufacturer or user to select a particular metal or alloy which should give the best service and maximum economy. This Technical Advisory Service, backed by the facilities of our Research Department, is available to all users of corrosion-resistant metals in any form."

V. A. Wilkins

Vice-President in Charge of Research and Development, Revere Copper and Brass Incorporated.

* We have available for distribution to interested manufacturers, metallurgists and production executives a few copies of the paper presented by R. A. Wilkins before the A. S. M. E. for the Symposium on Corrosion-Resistant Metals. If you desire a copy of this paper, write our Executive Offices, 230 Park Avenue, New York.

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REASON NUMBER 2

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IF the costs of rapid corrosion . . . costs made up from solution lost in leaky tanks, lost production, replaced parts and their installation, contamination of solutions and damage from leakage are not enough to spur the man who pays the bills to action, he should think of the poor devil who does the mole act through irritating muck and venomous gases. Years of habit have made these conditions seem necessary evils associated with the use of corrosive alkalies and acids. But they are not.

The Chemical Service Division of the American Hard Rubber Company has emancipated both employer and employe. Whether you handle corrosives in a quart dipper or a tank car, you will find complete ACE Hard Rubber Equipment available for every step of the way. Our book "ACE Hard Rubber Protection" tells of the progress that has been made. Send for it with the coupon today.

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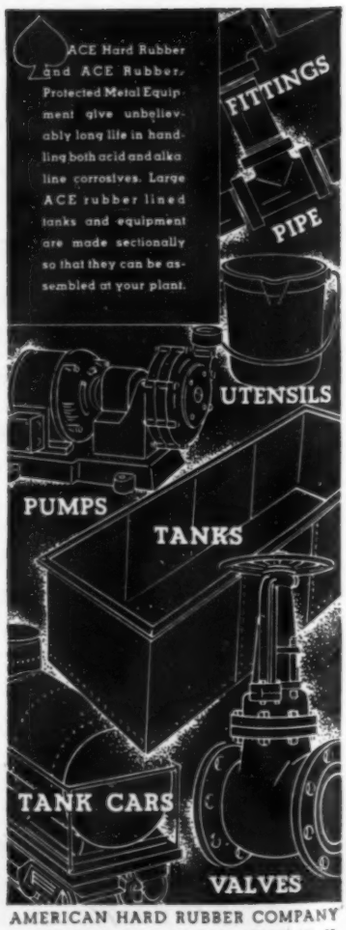
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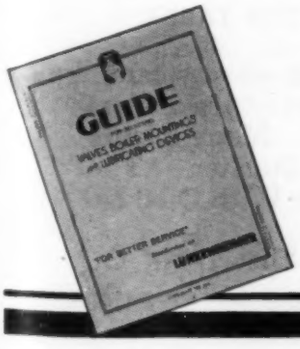
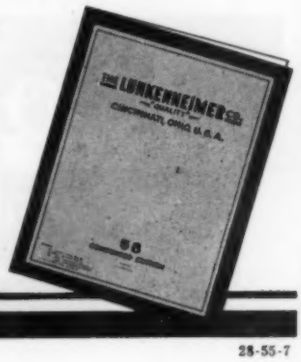


The Guide is a ready reference for selecting Valves, Boiler Mountings and Lubricating Devices in which products are grouped by pressure, type and use. The catalog describes and lists the Lunkenheimer line. Ask the distributor for copies or write us direct.



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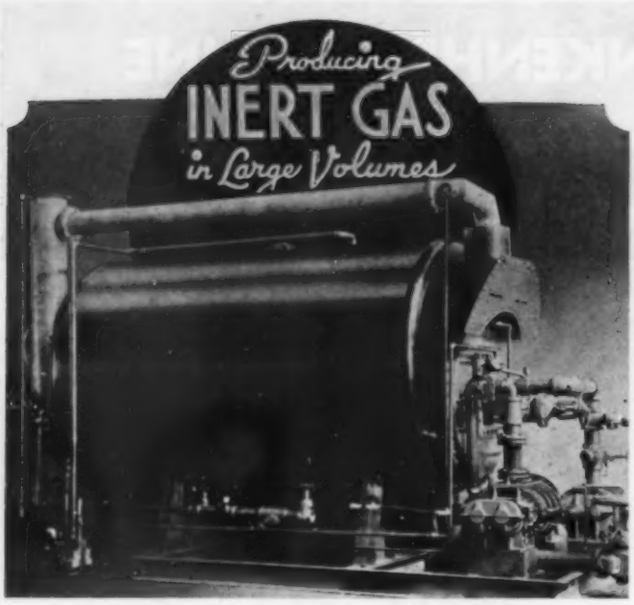

The low cost of inert gas produced from either gas or oil by the "R-C" Harrison Inert Gas Machine is opening up new fields for product improvements and increased safety.

Some installations, such as this one in a large Mid-western steel mill, call for the production of inert gas in large volume. This particular machine delivers 80,000 cu. ft. per hour. Other installations have been made in which a volume of 100,000 cu. ft. per hour is produced.

Where less inert gas is needed, "R-C" machines are available for the production of volumes as low as 1,000 cu. ft. per hour. Our engineers will be glad to cooperate with you in the design and application of a machine definitely adapted to your requirements.

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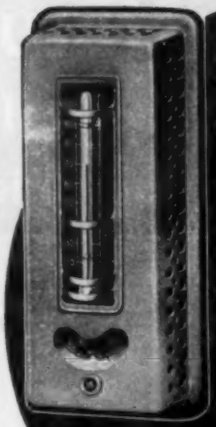

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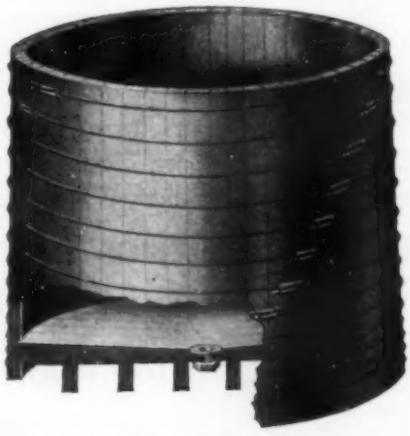

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Hundreds of round wooden tanks go into the country's chemical plants each year. Many plants specify Hauser-Stander. The reason is, We Win With Quality.

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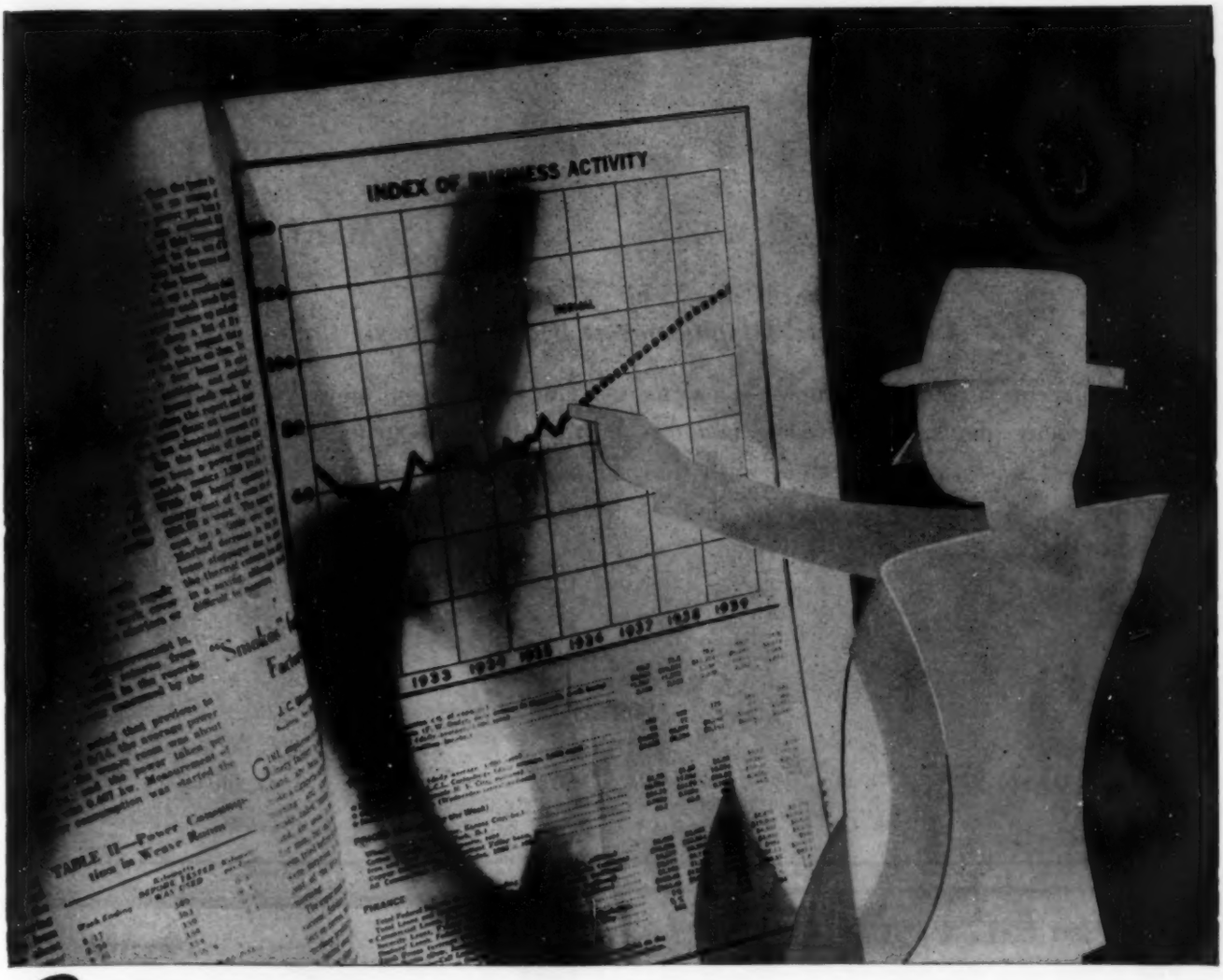

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CENTRIFUGAL EQUIPMENT

Are you equipped to handle the volume of business you will get next year? Observe the present increased business. Look at the definite upward trend in reliable forecasts.

You can't afford to wait to buy new equipment. Future business will depend on quality and delivery time, and the manufacturer who is prepared to meet the demands will get the business.

Then too, under the existing conditions, equipment prices are bound to rise.

Now is the time to order at the prevailing prices the centrifugal which will step up the production and quality of your products. R-E Engineers are prepared to assist you if necessary in the design of special centrifugals of special materials. Consult them on your centrifugal problems.

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A Controlled Displacement Wash is one of them

A displacement wash is not new—it's going on in many plants. But a *controlled* displacement wash, a displacement wash that delivers a filtrate of *exactly* the desired gravity—*that* is something so recent as to come under the heading of news.

The FEinc Continuous Vacuum Filter with the patented String Discharge has many other advantages you should know about when considering problems of filtration.

Your inquiries will be welcome.

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For determining the ABSOLUTE viscosity of gases, oils, greases, varnishes, viscous tars or syrups, according to the

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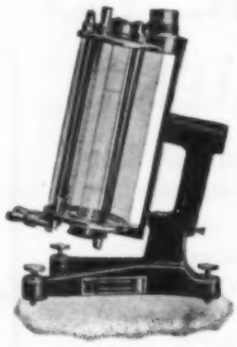
Direct readings in centipoises
Small sample (30 cc.) required

RESULTS CONSISTENT AND REPRODUCIBLE

Range: From 0.01 to 1,000,000 Centipoises

Accuracy: ±0.01% to 0.5%
Difference in viscosity between distilled and tap water can even be measured.



Bulletin HV 251 available on request.

When requesting detailed information, state range of measurements required.

Available at leading laboratory supply dealers.

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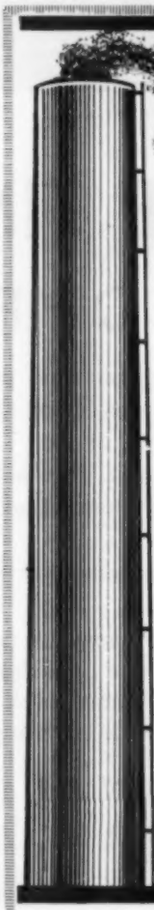

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Our various fabricated COLE steel products also include Smokestacks and Standpipes and you'll find them to stack up to your needs in every way. These stacks made to specification from your designs or ours, which our Engineering Department will gladly furnish. Put your Stack—also stack of problems—up to us.

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Write for "Tank Talk"—No. 9B.

For Warm Relations in Fabrication

R.D. COLE MFG.CO.
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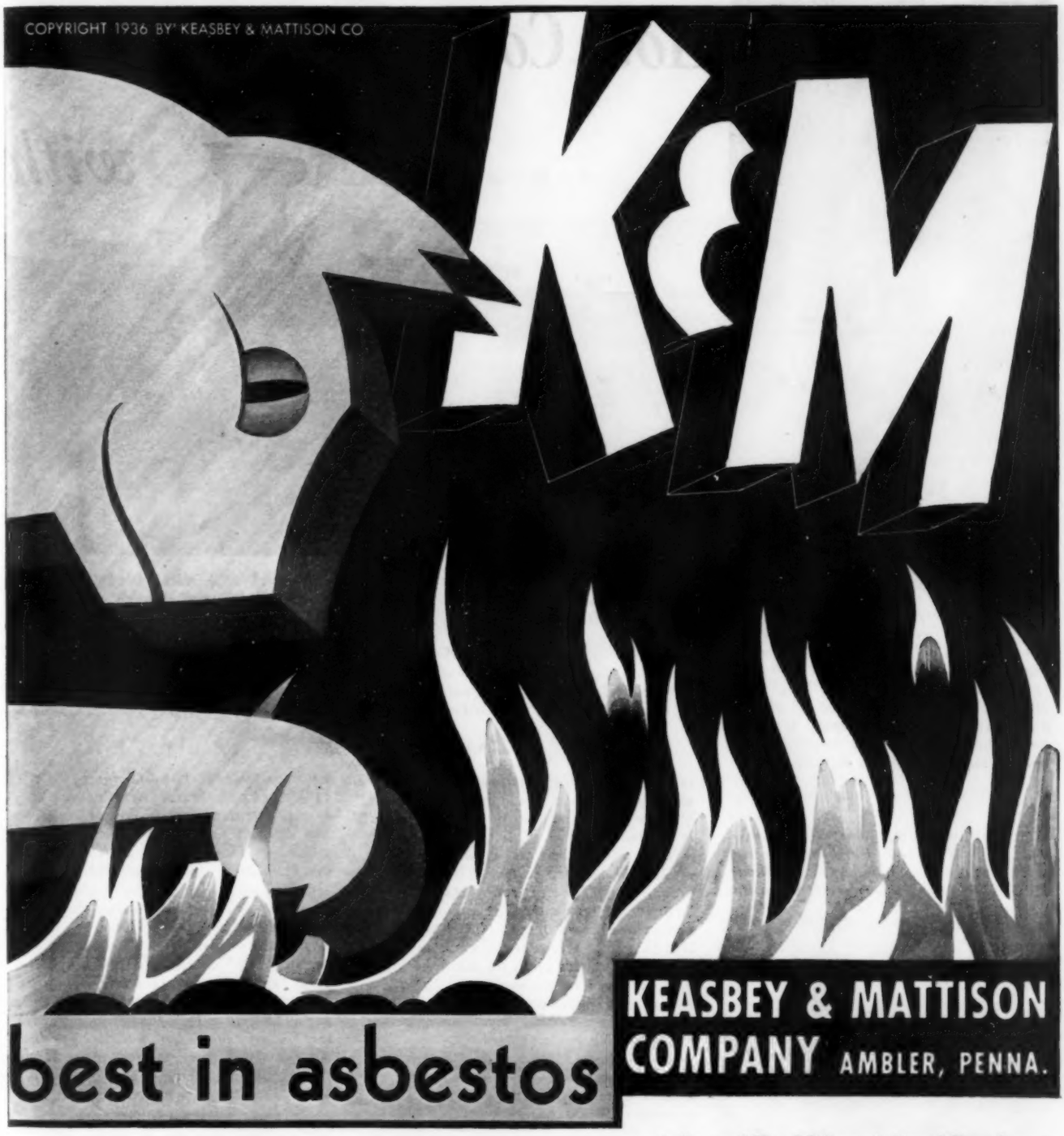

Economy may be your chief reason for using K & M Asbestos and Magnesia products. Their uniformity and durability may appeal most to you. K & M products are the perfected result of a rigid quality-control that starts with the raw asbestos fiber . . . their leadership rests upon more than 60 years spent in the development of insulation materials.

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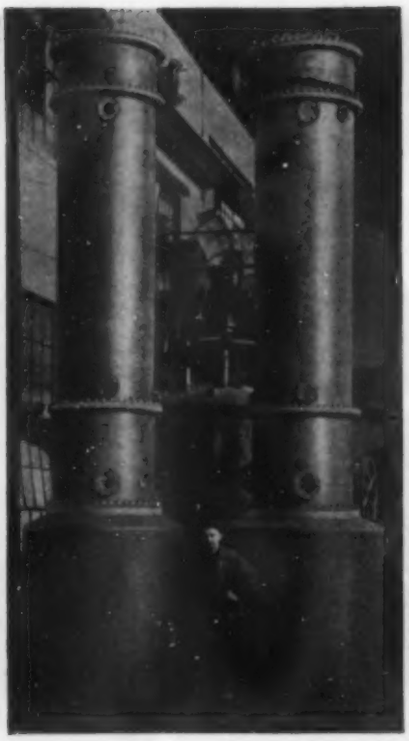
Asbestos Gaskets, Gasket Tapes and Cloth
Welding Electrodes (Celto)
Refractory Cements, dry and plastic
Asbestos Cement Sheets in corrugated and flat form

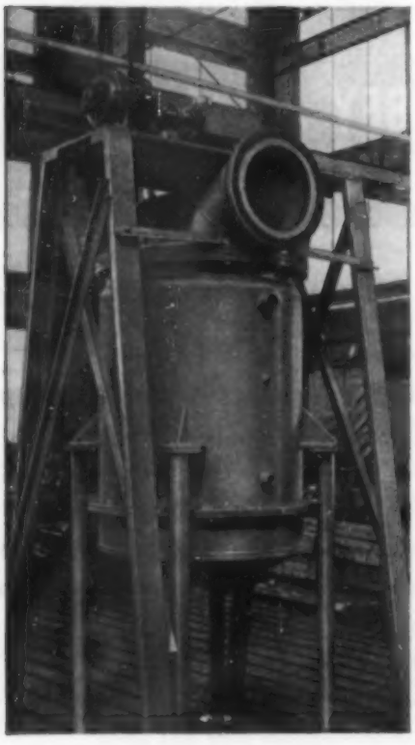
How Corrosion Problems with

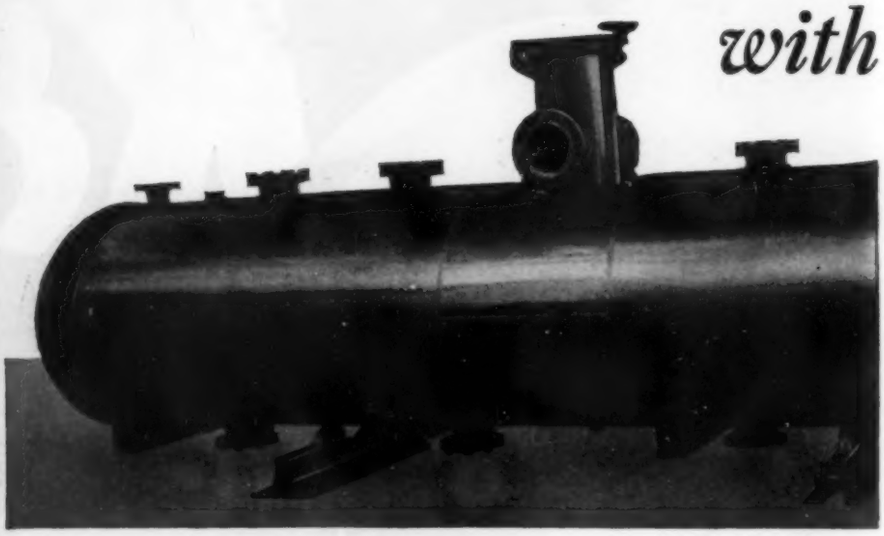


SURFACE CONDENSERS—*These two vacuum salt water surface condensers for creosote were equipped with Pure Nickel tube sheets and each unit has 385 1¼" O.D. x 16 gauge seamless Pure Nickel tubes 7' 11⅝" long. This Devine job is operating in the plant of a well-known creosoting company. It satisfactorily resists the combined corrosive conditions of salt water and hot creosote.*

• • •

SYNTHETIC RESIN EQUIPMENT—*(Below) A 3' 2" I.D. x 4' 3" high straight side jacketed vacuum Nickel Reaction and Mixing Kettle, used in the manufacture of certain synthetic resins. To keep the costs low on this job, it was necessary to evolve a special design in order to hold thicknesses of the Nickel shell to a minimum. This kettle was designed for a steam working pressure in the steel jacket of 25 p.s.i. and the bottom of the jacket is provided with a cooling coil to cool the batch at the end of the cycle. The inner shell and bottom head were of ⅝" Nickel plate. Although a large percentage of the area of the top head was taken up by the manhole, goose neck, and other openings, only ¼" thick Nickel plate was used in forming it, since the weight of the motor and speed reducer for the stirring device was supported separately on a steel "A" frame. Other special design features were incorporated, such as covering the 1" steel agitator shaft with a 2" O.D. x No. 10 gauge Nickel tube. Designed and built by The J. P. Devine Manufacturing Company, Inc., Mt. Vernon, Illinois.*

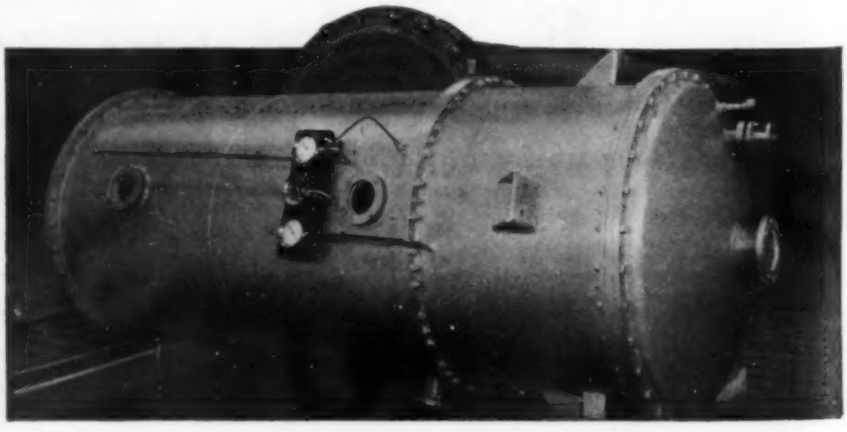




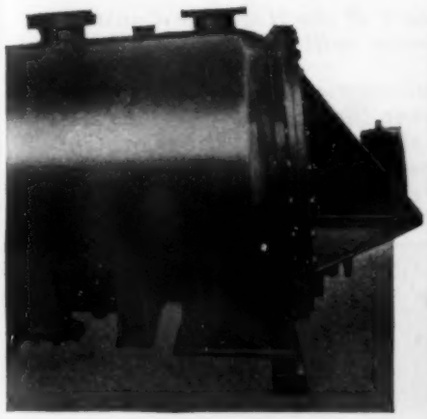
ROTARY VACUUM DRYERS—*One of two special Devine jacketed rotary vacuum dryers, each 4' 0" I.D. x 20' 0" long. All fabricated parts coming in contact with the charge or vapors are of Nickel or 20% Nickel-Clad Steel plate. Inner shell fabricated of ⅜" thick 20% Nickel-Clad Steel plate with cladding on inside. Each end of dryer is provided with 1¼" thick 20% Nickel-Clad Steel flat removable head, with cladding on the inside. Discharge door to open into a rectangular discharge chute made of ⅜" thick 10% Nickel-Clad Steel plate. These dryers, of all-welded construction, are heated with hot water and were engineered to handle a very difficult and unusual drying problem. The mate-*

• • •

VACUUM EVAPORATOR—*(Below) A 4' 6" x 11' 3" high straight side Nickel vacuum evaporator, exported to Italy for the concentration of fruit juices. The steam chest is of welded steel construction, since it does not touch the charge or vapors; but everything else is of welded pure Nickel construction. The vapor belt is of 5/16" Nickel; the top and bottom heads are of ⅜" Nickel. The heating surface is composed of 252–2" O.D. x No. 17 ga. x 3' 3½" long Nickel tubes. The 2–4' 11⅝" dia. x 1⅛" thick Nickel tube sheets were cut from a single Nickel plate, measuring 60" x 120" x 1¼" thick, weighing 2,850 lbs. The scrap pieces left after the circles were cut out of the sheet, were used for making flanges, observation glass fittings: no waste. Valves and fittings furnished with the job are of Nickel. Designed and built by The J. P. Devine Manufacturing Company, Inc., Mt. Vernon, Illinois.*



are Engineered NICKEL . . .



rials of construction were selected to avoid both contamination and corrosion, and a special, carefully supervised technique was followed in fabrication to insure quality of workmanship throughout.

Pictured here are a few typical examples of J. P. Devine Co.'s fabricating skill, gained from years of experience

IT'S no more than natural that the J. P. Devine Manufacturing Co., Inc., should use Nickel, Monel*, and Nickel-Clad Steel for so many of their processing vessels. For Devine specializes in equipment to combat corrosion.

These metals—the Nickel family—are old hands at keeping metallic contamination out of fine products.

To give just three examples—Monel and Nickel have been the standard for years in the manufacture of salt, of alkalis, and of fine chemicals.

They resist dilute hydrochloric acid, sulphuric acid, alkalis and many other potent corrosives. In fact, their range of corrosion resistance is wider than that of any other commercially available metal. On top of that, they are readily fabricable by all common methods. These are the reasons why the newer industries, like plastic manufacture, have opened wide their doors to Nickel and Nickel alloys.

The items of equipment shown here, typical of many others used in the process industries, are doing clean work day after day for their purchasers. And keeping way down costs of repair and replacement. You know these metals have higher strength and greater toughness than structural steel. And the engineering skill of the makers has utilized these properties to best advantage.

For even good metals can give inferior results when not properly designed and constructed. Devine's years of experience assure you that every installation is carefully built to handle successfully its particular job.

It may pay you rich dividends to get all the evidence on Nickel. Write for any or all of the following free bulletins:

"A Chemical Engineering Catalog of Monel Metal and Nickel Information"
"Nickel and Nickel Alloys in the Chemical Field To-day"
"Monel Metal and Nickel in the Manufacture of Pharmaceuticals, Fine Chemicals and Proprietary Products"
"Nickel Equipment for Plastic Manufacture"
"Lukens Nickel-Clad Steel—Corrosion Resistance at Economical Cost"
and List B, a complete record of all the bulletins on Monel and Rolled Nickel.

And clip the coupon; we'd like to mail you the fall issue of "Process Industries Quarterly."

ROTARY HOT AIR DRYER—*A 6' 10" I.D. x 40' 6" long Devine Rotary Dryer Shell during construction. This shell was of welded construction throughout, fabricated from ⅜" thick, 20% Nickel-Clad Steel. The plates from which the shell was formed were, it is believed, among the largest Nickel-Clad Steel plates ever to be rolled: they measured 120" wide x 259" long x ⅜" thick. The welding technique followed kept the iron dilution in the welds on the Nickel side down to a minimum, in order to make them as corrosion resistant as the Nickel cladding. The dryer was equipped with Monel flights, riveted to the shell with Monel rivets. Built by The J. P. Devine Manufacturing Company, Inc., Mt. Vernon, Illinois.*

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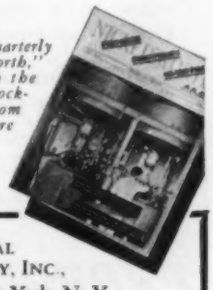
The fall issue of our quarterly publication, "Nickelsworth," deals exclusively with the process industries. It is chockful of actual records from users whose problems are yours.



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MONEL **INCO MONEL** **INCO NICKEL**

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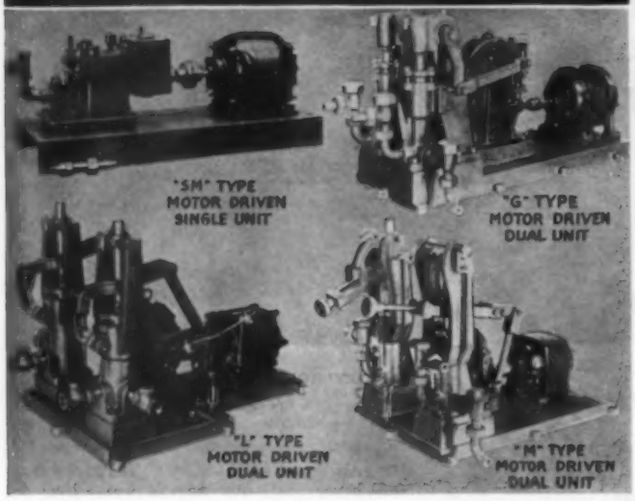

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These Pumps are built to suit individual plant conditions, in 4 types and over 200 sizes in a range of capacities up to 6,000 G.P.H. at pressures up to 12,500 lbs.

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Scores of users of the Hardinge Constant Weight Feeder will testify to this:—

We sell Volumetric Feeders at a lower price, but when the purchaser investigates he almost always selects the Constant Weight type. There must be—and is a reason! Write for Bulletin 33C.

HARDINGE COMPANY
INCORPORATED
YORK, PENNA.—Main Office & Works
NEW YORK—122 E. 42nd St. CHICAGO—205 W. Wacker Drive

Highest Quality
Platinum Products

Applicators	Gauze	Sheet
Black	Injectors	Solutions
Boats	Micro-apparatus	Spatulas
Bottles	Muffles	Spinnerettes
Catalysts	Needles	Sponge
Cautery Pts.	Nozzles	Stills
Contacts	Pans	Syphons
Crucibles	Parting Appa.	Thermocouples
Dishes	Pins, dental	Tongs
Electrodes	Plate	Triangles
Filter Cones	Retorts	Tweezers
Foil	Rivets	Tubing
Funnels	Salts	Wire

SPECIAL APPARATUS AND EQUIPMENT
Manufactured to customers' specifications with materials and workmanship fully guaranteed.

METALLIC
Platinum, Iridium, Palladium, Osmium, Ruthenium, Rhodium, their alloys, salts and solutions.

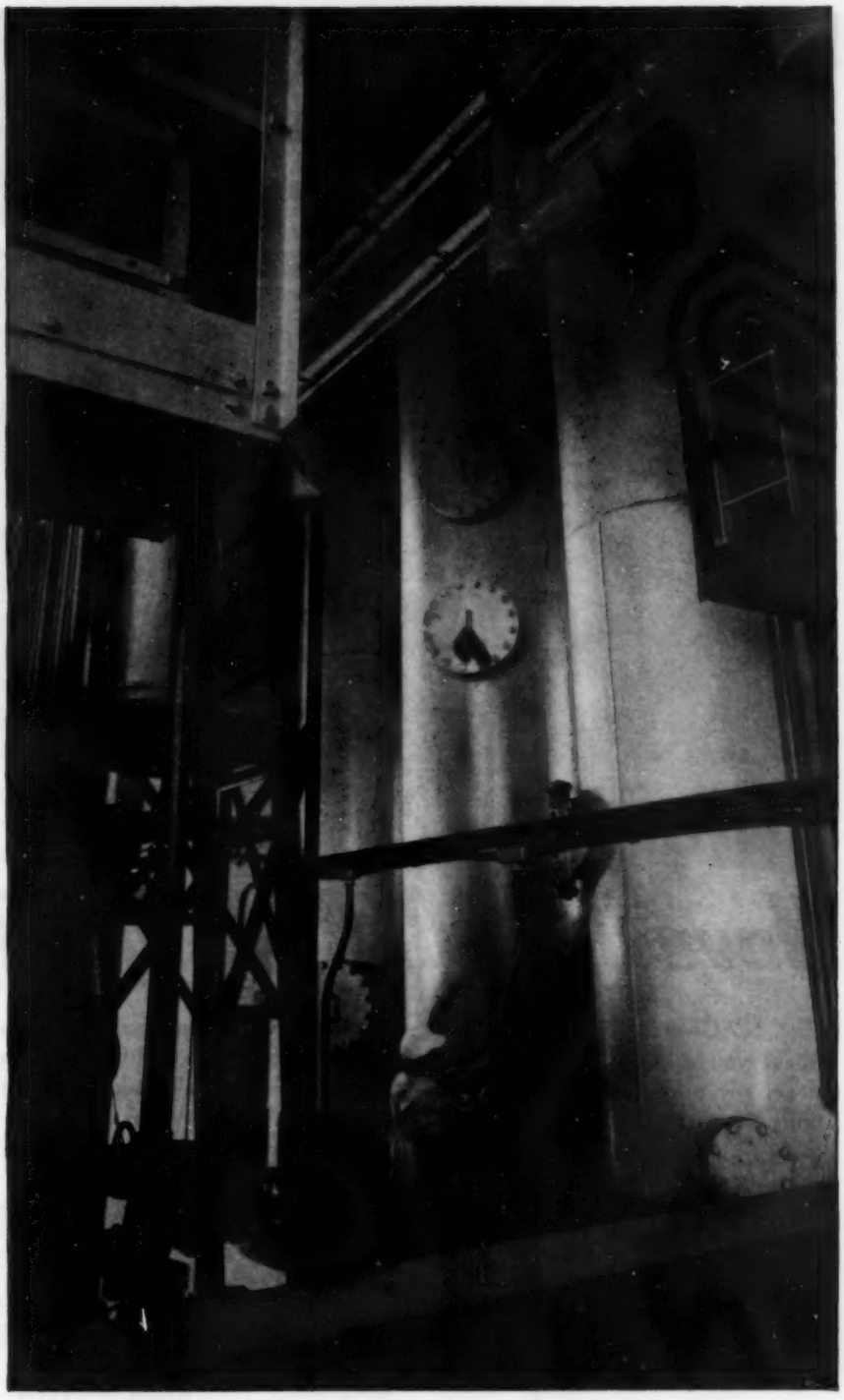
PLATING SOLUTIONS
Platinum, Rhodium, Palladium.

"First platinum works in the United States"

JB 1842

J. BISHOP & CO.
PLATINUM WORKS
MALVERN, PA.

STILLS THAT SAVE DOLLARS in recovery of VOLATILE SOLVENTS



Lummus designs and builds plants for recovering ethyl alcohol, acetone, ethyl acetate, butyl acetate, benzol, toluol, naphthas, and other volatile solvents.

Lummus stills have high recovery efficiency, operate with the minimum of attention, are economical in the use of steam and deliver the solvents in their original state of purity.

If you have a problem in solvent recovery, Lummus Engineers will be glad to confer with you and submit suggestions.

THE LUMMUS COMPANY, 50 CHURCH STREET, NEW YORK, N. Y. • BUSH HOUSE, ALDWYCH, LONDON, W. C. 2

LUMMUS

CHEMICAL DISTILLATION EQUIPMENT

Only BLACKMER ROTARY PUMPS Have this GREAT ECONOMY PRINCIPLE

The BLACKMER "Bucket" Principle gives you a pump totally different from any other rotary . . . a pump that takes up its own wear automatically . . . that concentrates the wear on inexpensive buckets, and provides for their simple, easy replacement.

Working parts of a BLACKMER Pump consist ONLY of the rotor and the SWINGING buckets. As the rotor turns, these buckets swing out by centrifugal force and ride lightly against the pump case. This action plus our unique rotor construction provides excellent hydraulic balance LOWEST POWER COSTS.

These buckets bear the brunt of all the wear. But as they wear, centrifugal force swings them out farther so that perfect contact with the pump case is always maintained, without loss of pump efficiency or capacity.

NEW INTEGRATED UNITS

Exclusive 3 Point Base makes installation easy. Built-in Strainers, Built-in Bypasses, Enclosed Lubricated Drives, and, of course, the "Bucket" Principle—all standard at no extra cost.

WRITE FOR BULLETIN IU300 which covers BLACKMER Integrated Units—most modern, most complete obtainable. And so simple of design that any one who can handle a wrench can service them. Let us show you how to cut pumping costs. Get your copy today.

When replacement of the buckets finally becomes necessary, any mechanic can do the job in 15 minutes, simply by removing the outboard head, sliding old buckets out, sliding new ones in, and replacing the head. Pipe connections are not disturbed. And the cost of the buckets averages LESS THAN 5% OF ORIGINAL PUMP COST.

BLACKMER is today furnishing industry with rotary pumps for practically every type of liquid handling service—pumping acids, alkalies, oils, gasoline, paints, varnishes, etc. If you are planning to replace, modernize or expand your pumping equipment, by all means will it pay you to investigate BLACKMER'S proven record of pumping "More Gallons per Dollar."

BLACKMER PUMP COMPANY

MAIN OFFICE: GRAND RAPIDS, MICH. — DISTRICT SALES OFFICES: Atlanta, Baltimore, Boston, Buffalo, Charlotte (N. C.), Chicago, Cleveland, Dayton (Ohio), Denver, Detroit, Houston, Indianapolis, Kansas City (Mo.), Los Angeles, Milwaukee, Minneapolis, Mobile, New York, Omaha, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle, Tulsa, Salt Lake City.

4 of 7

KELLOGG MASTERWELD TUMBLING DIGESTERS

for Pacific Coast Paper Mills

■ Kellogg "Masterweld" ("THRUSHAFT")* tumbling digesters, 10 ft. 1 in. O. D. x 26 ft. 0 in. and 22 ft. 6 in. over all 1½ in. thick fabricated according to the A. S. M. E. code from Kellogg analysis killed steel.

■ The ("THRUSHAFT")* design eliminates excessive stresses and consequent rapid corrosion in the shell of the digester adjacent to the trunnion pads. The rigidity of this construction also maintains the trunnions and gears in perfect alignment.

■ These digesters are further evidence of the ability of the Kellogg organization to fabricate special equipment to meet present-day demands of the process industries.

* Patent applied for

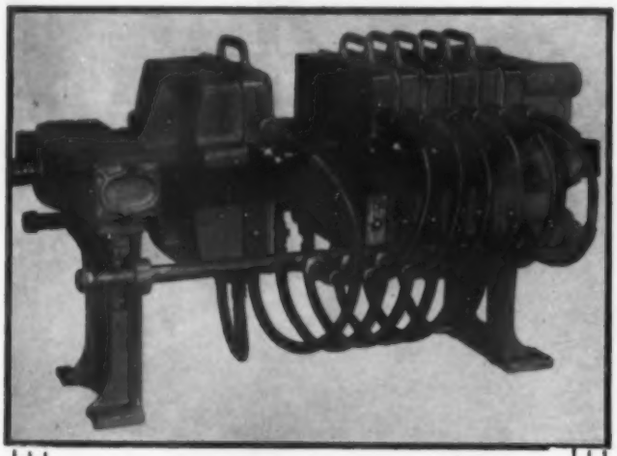
THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK

Los Angeles: 1031 South Broadway Houston, Texas
Chicago: 1 La Salle Street Tulsa: Philtower Building

KELLOGG

Pressure vessels "Masterweld" for the Power, Refinery and Chemical Industries. Power Plant and Industrial piping. Heat Exchangers, Radial Brick Chimneys, Plastic Refractories. Cross, Holmes-Manley, de Florez and Tube and Tank cracking units. Gas Polymerization Units. Deasphalting, Dewaxing, Solvent Extraction, Acid Treating Plants, Absorption Plants and Pipe Stills.

Is Your Filtration Problem Difficult?



Typical of many special units Shriver designs, this steam heated washing type filter press is equipped with hollow, machined, rolled stainless steel filter plates, used by a large chemical manufacturer for difficult investigations in filtration.

New products to filter—new improved materials of construction to withstand their chemical characteristics—new types of Filter Presses to meet difficult operating conditions!

SHRIVER FILTER PRESSES

are the result of the broadest experience in the filtration of the greatest variety of products ever assembled by one engineering organization. That experience, gained from its own extensive laboratory researches and the performance of Shriver Filter Presses in thousands of plants, is available to help you solve your filtration problems.

Ask for the complete Shriver catalog.

T. SHRIVER & COMPANY

Main Office and Factory: 808 Hamilton Street, Harrison, N. J.
Western Representatives: The Merrill Co. 343 Sansome St., San Francisco, Calif.

We Get More Money for

WOOLFORD WOOD TANKS

—BECAUSE they are sound, well-built, properly designed and reinforced.

— BECAUSE they are made of highest grade woods, properly seasoned and chosen as a result of our experience since 1854 with various kinds of wood in chemical service.

Certainly

we get more for them! They are worth more! And we have a thousand good customers who will tell you they are the cheapest tanks, the most economical tanks, that can be bought at any price.

If you want better wood tanks, for any purpose, we should be glad to consult with you.

G. WOOLFORD WOOD TANK CO.

Paschall P. O., Philadelphia, Pa. Factory: Darby, Pa.

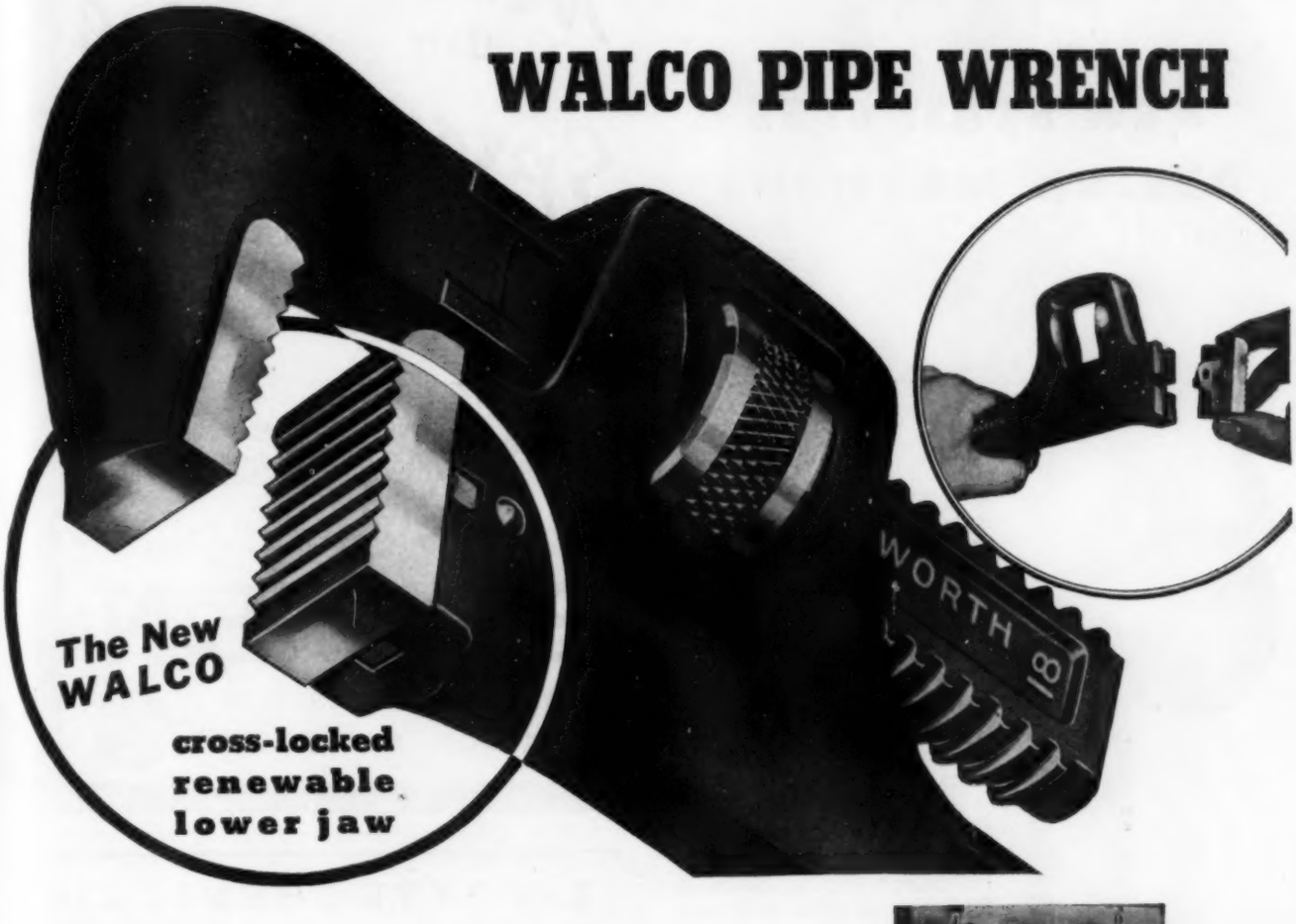
•Trouble-free operation is assured. No wear—no filtering units to replace—no manual supervision—no fire hazard. Highly efficient. Descriptive literature sent on request. The C. O. Bartlett & Snow Co., 6215 Harvard Ave., Cleveland, Ohio. Representatives in the principal cities.

BARTLETT SNOW DUST COLLECTORS

BARTLETT-SNOW
Dust Collectors
CONVEYORS • ELEVATORS • SKIP HOISTS • FEEDERS
CHAINS • SPROCKETS • DRYERS • COOLERS • SCREENS

BUILT FOR LONG SERVICE...

WALCO PIPE WRENCH



The Walco Wrench is built for heavy duty. Its life is practically indefinite, for the part on which wear focuses—the teeth on the lower jaw—is renewable. New lower jaws, made of specially-hardened steel, can be inserted in place in a few minutes.

Safety is an inherent feature of Walco Wrenches. All parts are of drop-forged steel, with integral forged housings; all parts are heat-treated and Parkerized against rust. The renewable lower jaw cannot slip, and even severe abuse cannot spoil Walco's grip. No tools are necessary to replace the spring. Adjustment is easy—as the nut can be spun with the palm of the hand.

Walco—strongest made and longest lived—in the long run will save you the most money.

PRE-PROVING WALWORTH QUALITY

This metallurgical microscope discloses and records the internal structure of metals, thus providing a check on the quality of product . . . in the forged state . . . after heat treatment . . . after subjection to service . . . or any simulated service condition.

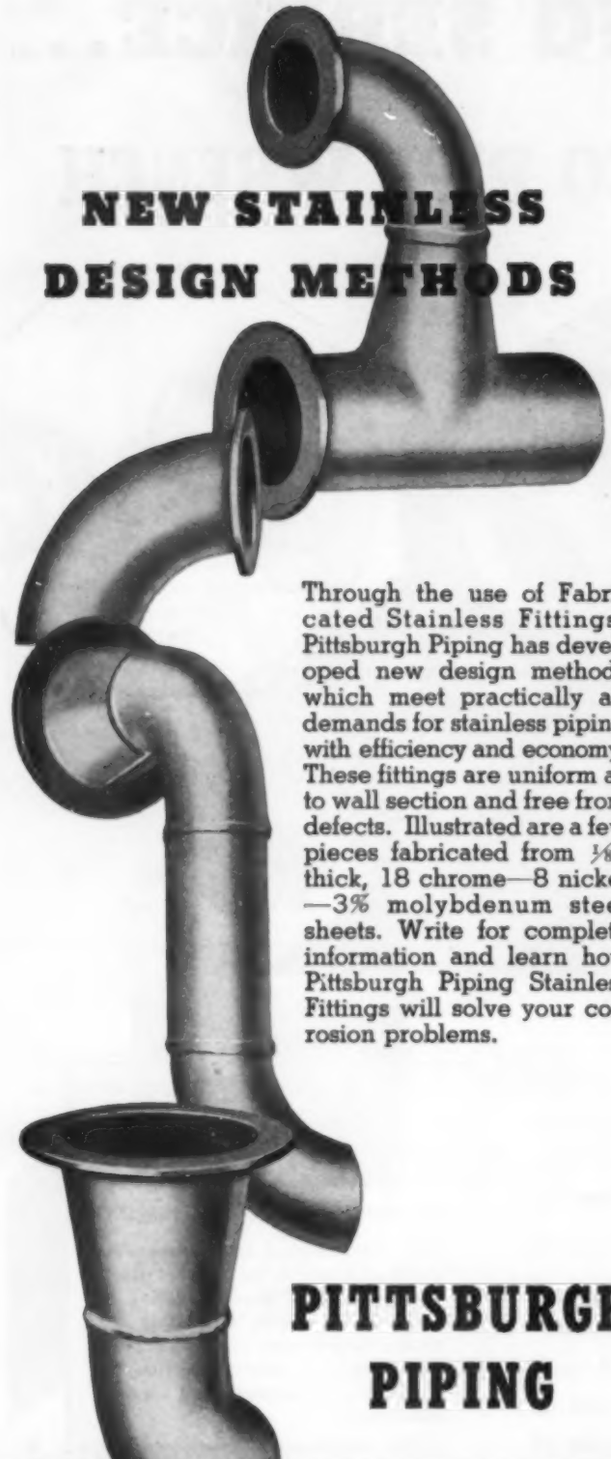
This microscope is another of the many devices with which Walworth predicts the uniform high quality of its products. Field performance finds Walworth quality unsurpassed.

WALWORTH

VALVES
FITTINGS
and TOOLS
Backed by
94 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL
CITIES THROUGHOUT THE WORLD



NEW STAINLESS DESIGN METHODS

Through the use of Fabricated Stainless Fittings, Pittsburgh Piping has developed new design methods which meet practically all demands for stainless piping with efficiency and economy. These fittings are uniform as to wall section and free from defects. Illustrated are a few pieces fabricated from 1/8" thick, 18 chrome—8 nickel —3% molybdenum steel sheets. Write for complete information and learn how Pittsburgh Piping Stainless Fittings will solve your corrosion problems.

PITTSBURGH PIPING

Stainless Fittings

Pittsburgh Piping & Equipment Co.
10 Forty-third St., Pittsburgh, Pa.

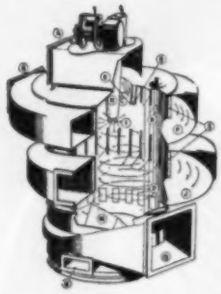
Please send information on your Fabricated Stainless Fittings.

Name .....

Company .....

Address .....

New UNIT *Spray Drying* and REACTION CHAMBERS



SIZES 5 and 10
For detailed explanation send for Bulletin No. 3.
PATENT ALLOWED AND PENDING

BOWEN

RESEARCH CORPORATION
GARWOOD, NEW JERSEY

LAMOTTE CHEMICAL CONTROL SERVICE

LAMOTTE UNIVERSAL pH OUTFIT

This compact LaMotte outfit is readily portable, yet it covers a wide pH range. Can be supplied with any 3, 4, 5, 6, 7 or 8 sets of LaMotte Permanent Color Standards and will therefore cover any desired part of pH range, 0.2–13.6. Applicable to all types of research and industrial pH work. Accurate to 0.1 pH. Excellent for use with highly colored or turbid solutions.

Price $35.00 to $60.00 f. o. b. Baltimore, Md.

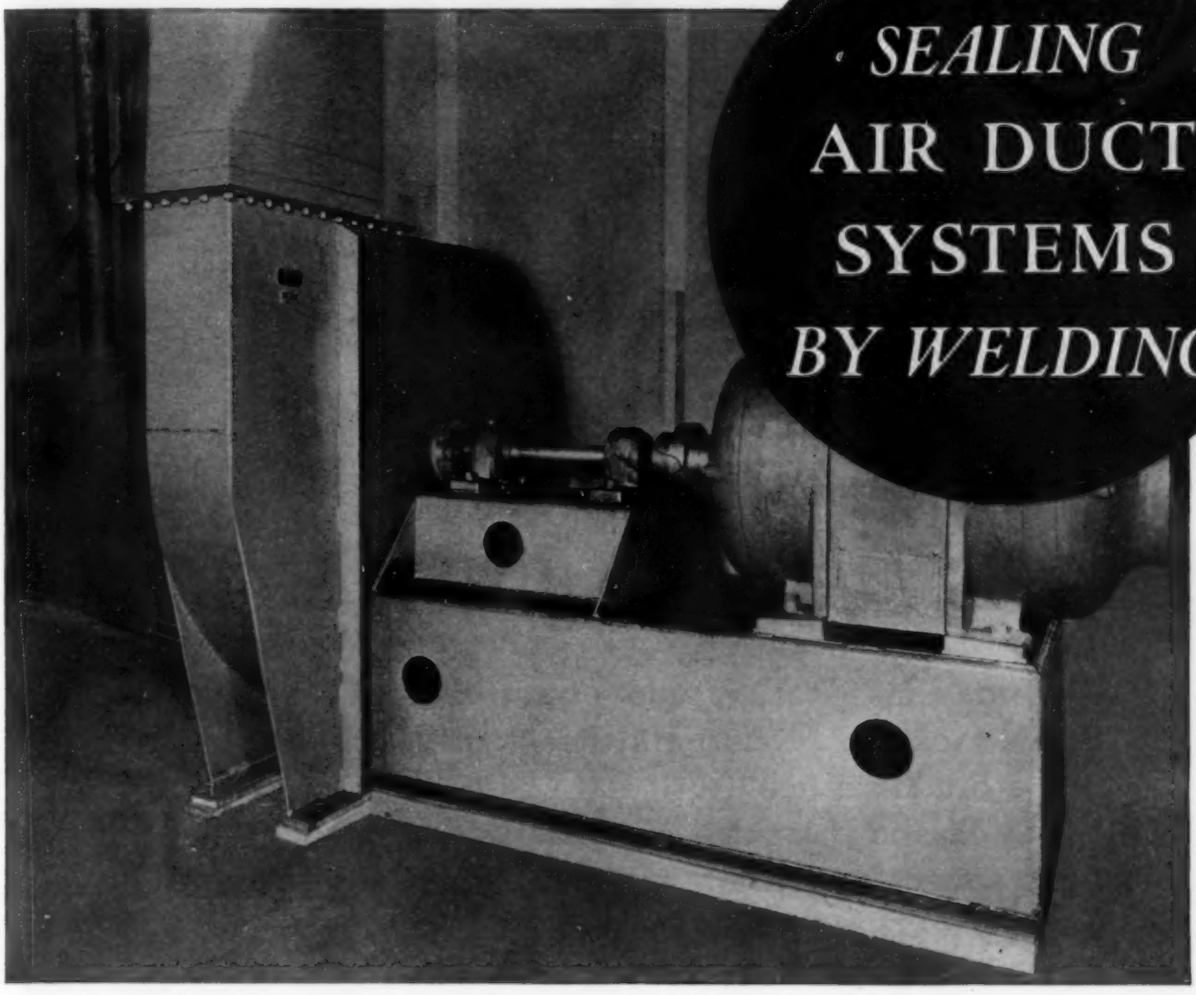
LAMOTTE PERMANENT COLOR STANDARDS

These sealed liquid standards are unquestionably the most accurate type made, since all other types are made by matching against such standards. They have the great advantage of permitting a comparison of a test sample and standard of a similar medium and identical color elements. Available over the entire range from 0.2–13.0 pH in intervals of 0.2 pH. Packed in sets of 9, plus a tube of distilled water.

Set of 10 ampoules $5.00 f. o. b. Baltimore, Md.

LAMOTTE
CHEMICAL PRODUCTS CO.
Originators of Practical Application of pH Control
444 Light St. Baltimore, Md.

The entire duct system in this solvent recovery unit is oxy-acetylene welded. This picture shows one of the welded ducts and the stand for the blower motor, also welded.



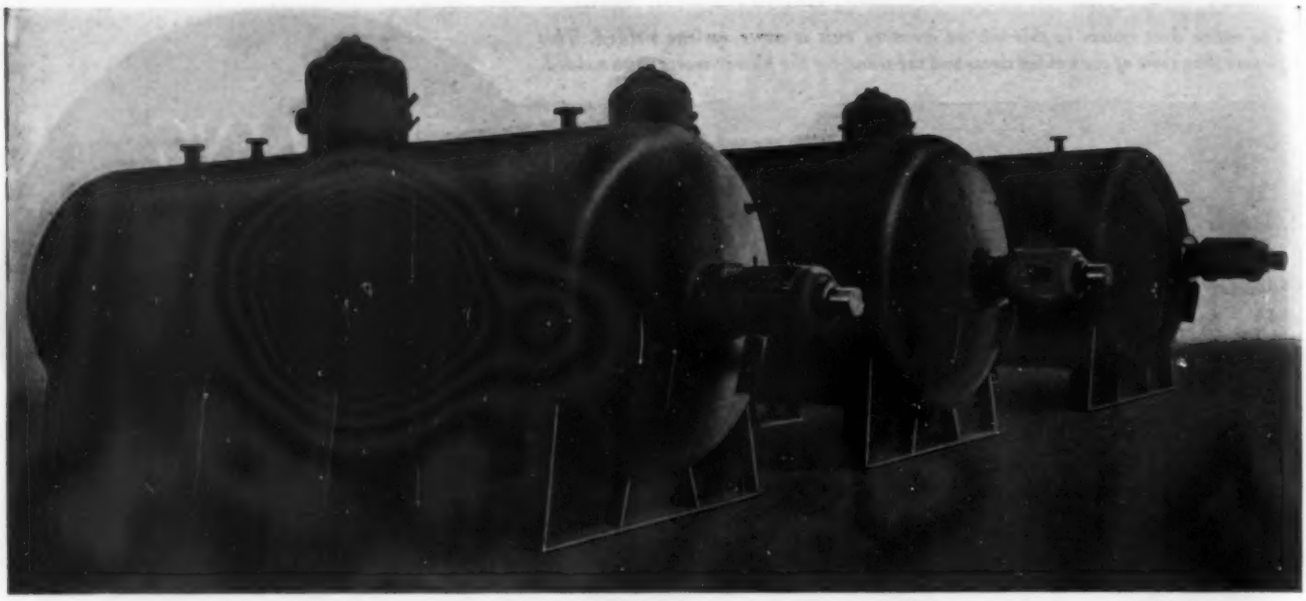
SEALING AIR DUCT SYSTEMS BY WELDING

Oxy-acetylene welding, the modern method of joining piping for most industrial purposes, is also a positive way of sealing air ducts for air conditioning, ventilating and chemical use. Air ducts so welded are permanently air-tight, and are sound assurance that the completed project will be forever free from joint maintenance.

The Linde organization has accumulated a wealth of experience and understanding in the design and fabrication of welded piping and ducts of all kinds. It is thus in a position to assist your engineers with welded piping and duct projects from the first blue prints to the testing of the finished installation. Users of Linde products can obtain this help when they need it by communicating with the nearest Linde Office or 30 East 42nd Street, New York, N.Y. Address: The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation.

Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES FROM UCC LINDE UNION CARBIDE



"THEY CAN TAKE IT"

Yesterday six—today nine—three more Blaw-Knox Steam Jacketed Mixing and Reaction Vessels are put into a brutal service.

Day in and day out—continually subjected to the most severe expansion and contraction forces—yet never a leak—no trouble—no interruptions in production—"They Can Take It."

The first of these vessels have been in service for seven years and today they are doing yeoman duty—250 pounds pressure in the jacket—200 pounds in the shell—alternately heated and cooled—subjected to twisting strains—but ingenious Blaw-Knox design—permitting both shells to move in either direction entirely independent of each other, gives them a resiliency that continued punishment can not destroy.

BLAW-KNOX COMPANY

2090 FARMERS BANK BUILDING PITTSBURGH, PA.

BLAW-KNOX

BLAW-KNOX PROCESS EQUIPMENT INCLUDES

Inclined High Velocity Evaporators	Vacuum Rotary Dryers	Vulcanizers	Heat Exchangers
Vertical High Velocity Evaporators	Extraction Apparatus	Absorbers	Condensers
Forced Circulation Evaporators	Distillation Equipment	Impregnating Equipment	Mixing Equipment
Rotary Dryers Autoclaves	Hot Oil Circulating Systems	Solvent Recovery Systems	Distilled Water Evaporators

PLATINUM MASS CATALYSTS

ARE ECONOMICAL, EFFICIENT AND FLEXIBLE

ECONOMY

The equipment is compact and a small bulk of mass can be used. This keeps the power cost low.

Labor cost is comparatively small because due to their flexibility, platinum masses require minimum control for maximum efficiency.

Ninety per cent of the platinum can be recovered after ten years of service.

In 1934, using an average of five ounces of platinum per daily ton, the average investment per ton per day for platinum catalyst was $250.

EFFICIENCY

Platinum masses show high conversion rates even at those low temperatures where highest conversion is theoretically possible.

Platinum masses have low kindling temperatures.

FLEXIBILITY

Platinum masses are efficient in all ranges of SO_2 concentrations encountered in practice.

They are not sensitive to variations in gas concentration and convert overloads with economy.

In an emergency, the output of a converter charged with platinum mass can be raised to meet it, provided there is ample blower capacity.

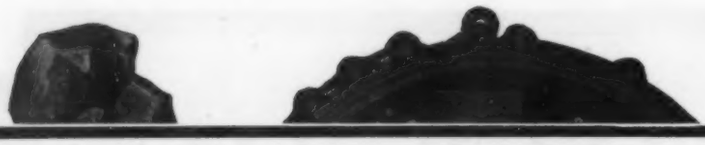
WHEN YOU BUY PLATINUM

Whenever you buy platinum metal, platinum chloride or finished contact mass, be sure you obtain only specially refined material. In purchasing from us, you are assured of the highest possible purity.

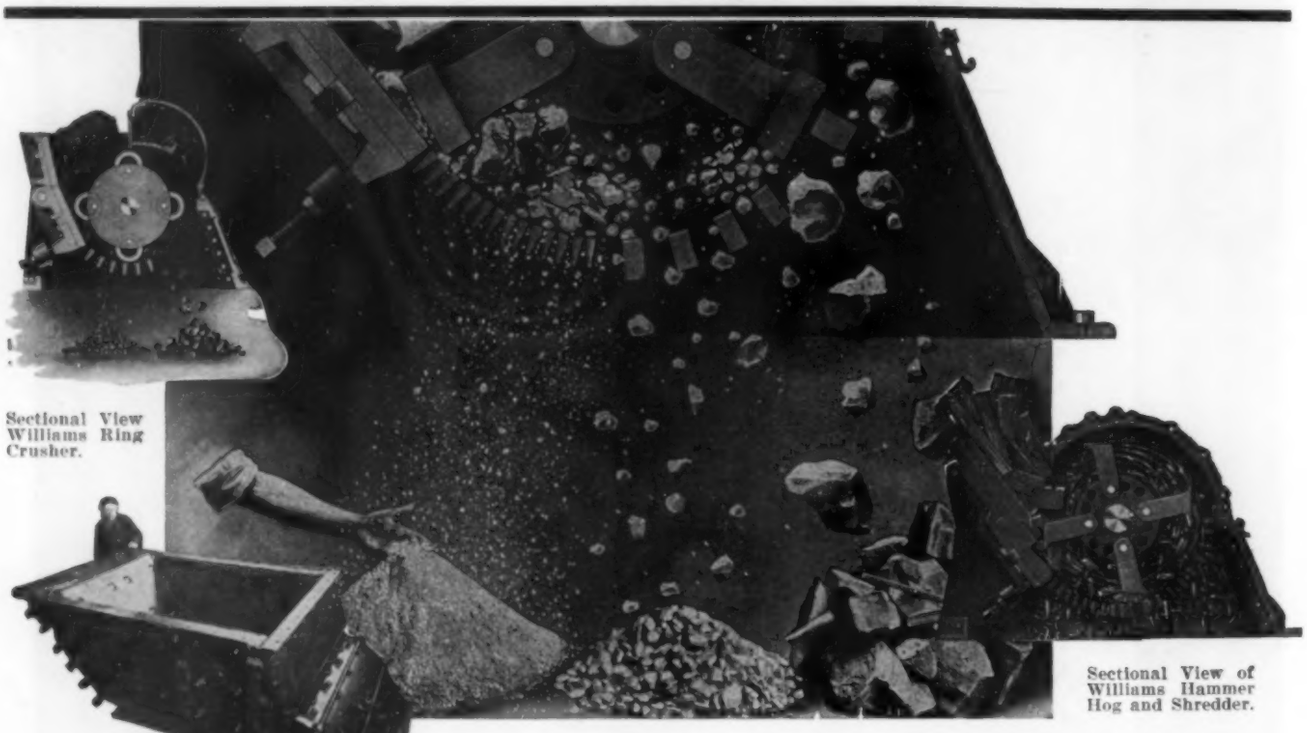
BAKER & CO., INC.

54 Austin Street, Newark, N. J.

NEW YORK SAN FRANCISCO CHICAGO



More Efficient Crushers, Grinders, Shredders



Sectional View Williams Ring Crusher.

Sectional View of Williams Hammer Hog and Shredder.

Cover and Feed Opening of Williams "Mammoth" Crusher which reduces 4 foot Limestone to ¾ inch.

Williams Roller Mill with Air Separator.

Hammer Crushers—The Williams "Mammoth" type crushes 4 foot limestone to ¾ inch in one operation. Other sizes crush coal for by-product ovens, grind animal and vegetable by-products and perform hundreds of other crushing, grinding and shredding operations. 50 sizes. Capacities 200 pounds to 700 tons per hour.

Roller and Impact Mills with Air Separation—Grind to finenesses ranging from 50-mesh to 325-mesh or to micron sizes. Dry and grind simultaneously.

Ring Crushers—15 sizes of Ring Crushers for reducing coal, steel turnings, dry chemicals and other materials.

Hogs and Shredders—Williams Hammer Hogs and Shredders reduce waste wood, roots and herbage, bark and paper stock. No knives to sharpen or be damaged by iron.

WILLIAMS PATENT CRUSHER & PULVERIZER COMPANY

2706 N. NINTH ST., ST. LOUIS, MO.

Chicago	New York	San Francisco
37 W. Van Buren St.	15 Park Row	326 Rialto Bldg.

WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. THE TRADE MARK

Williams

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

WILLIAMS

PATENT-CRUSHERS GRINDERS SHREDDERS

Refining has created new problems of

PRESSURE

. . . . . .

TEMPERATURE

. . . . . .

CORROSION

. . . . . .

in the solution

of which you

can be helped by

MIDVALE

Refining as it exists today would be impossible without—steel. And economical and effective refining is made more difficult without—the right steel. Probably no other industry has so many "special-purpose" requirements as does the oil industry.

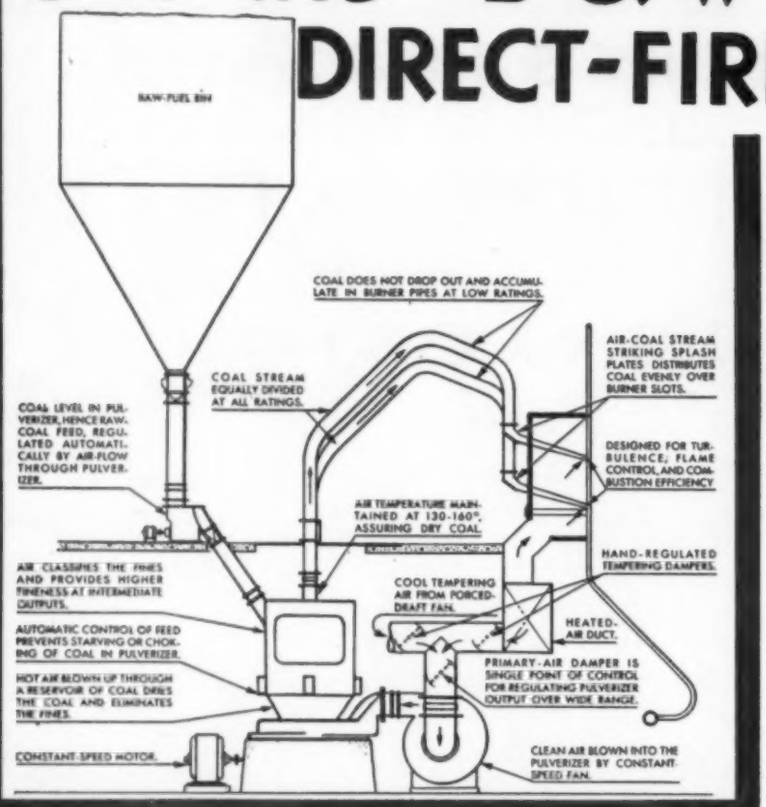
In the steel industry Midvale has rightfully earned a reputation as makers of special-purpose steel. In the oil field it has the record of successful installations in continuous-furnace parts, retorts, boxes, recuperator tubes, stoker grates, tuyeres, chains, slicing links, sulphide roasting furnace parts, cast pyrometer tubes and an almost endless list including gas-industry equipment.

At a time when efficient, economical production is one of the elements vital to existence—Midvale is ready to help you.

THE MIDVALE COMPANY · · NICETOWN, PHILADELPHIA

OFFICES: ***New York · Chicago · Pittsburgh · Washington · Cleveland · San Francisco***

In the B & W DIRECT-FIRING SYSTEM


RAW-FUEL BIN
COAL DOES NOT DROP OUT AND ACCUMULATE IN BURNER PIPES AT LOW RATINGS.
AIR-COAL STREAM STRIKING SPLASH PLATES DISTRIBUTES COAL EVENLY OVER BURNER SLOTS.
COAL STREAM EQUALLY DIVIDED AT ALL RATINGS.
COAL LEVEL IN PULVERIZER, HENCE RAW-COAL FEED, REGULATED AUTOMATICALLY BY AIR-FLOW THROUGH PULVERIZER.
DESIGNED FOR TURBULENCE, FLAME CONTROL AND COMBUSTION EFFICIENCY.
AIR TEMPERATURE MAINTAINED AT 130-160°, ASSURING DRY COAL.
HAND-REGULATED TEMPERING DAMPERS.
AIR CLASSIFIES THE FINES AND PROVIDES HIGHER FINENESS AT INTERMEDIATE OUTPUTS.
COOL TEMPERING AIR FROM FORCED-DRAFT FAN.
AUTOMATIC CONTROL OF FEED PREVENTS STARVING OR CHOKING OF COAL IN PULVERIZER.
HEATED-AIR DUCT.
PRIMARY-AIR DAMPER IS SINGLE POINT OF CONTROL FOR REGULATING PULVERIZER OUTPUT OVER WIDE RANGE.
HOT AIR BLOWN UP THROUGH A RESERVOIR OF COAL DRIES THE COAL AND ELIMINATES THE FINES.
CONSTANT-SPEED MOTOR.
CLEAN AIR BLOWN INTO THE PULVERIZER BY CONSTANT-SPEED FAN.

THE IMPORTANT FUNCTIONS OF AIR-FLOW are performed

EASILY • SAFELY • EFFECTIVELY •

High moisture coal can be used—

Coal of any moisture that can be transported to the raw-coal bin can be handled by the B&W Direct-Firing System. It passes freely through the feeder and is dried in the pulverizer by heated air blown through the coal reservoir in the grinding zone.

Takes only finished product out of the pulverizer—

The air is so guided through the pulverizer that it carries out the fines at the desired rates as soon as formed, leaving the grinding elements unhampered by finished product. No external classifier is required.

Provides quick response to load changes—

Accurate and practically instantaneous response to load requirements is obtained by varying the rate of air flow through the pulverizer. This may be done either manually or by means of automatic combustion control.

Prevents choking or starving of pulverizer—

Rate of feeding raw coal, to provide proper coal level in the pulverizer, is under complete automatic control, actuated by air flow through the pulverizer.

Provides higher fineness at intermediate outputs—

At the intermediate and lower ranges of output, full pulverizer capacity is utilized to provide fineness higher than standard, with its attendant advantages. This feature is inherent in the design.

Distributes uniform mixture of coal and air evenly to all burner pipes—

Controlled flow of air through pulverizer thoroughly mixes finely pulverized coal and primary air and distributes this uniform mixture equally to the burner pipes.

Transports the coal—

The primary air carries the fines through the burner pipes and at such a velocity that no coal lodges in the pipes and burners at any rating.

Provides safety in lighting-off—

Reservoir of coal in pulverizer and method of handling primary-air flow on starting provides rich and safe mixture for lighting-off.

Produces high combustion efficiency—

Controlled flow of primary and secondary air at burners provides accurate mixture of coal and air for efficient combustion, required turbulence, and flame control.

In any direct-firing system there are certain important requirements that are met only through air-flow. To meet these requirements, or any combination of them, at any time requires the complete coordination that is characteristic of the B&W Direct-Firing System.

THE BABCOCK & WILCOX COMPANY, NEW YORK, N. Y.

BABCOCK & WILCOX

G-91

Send for this Leaflet

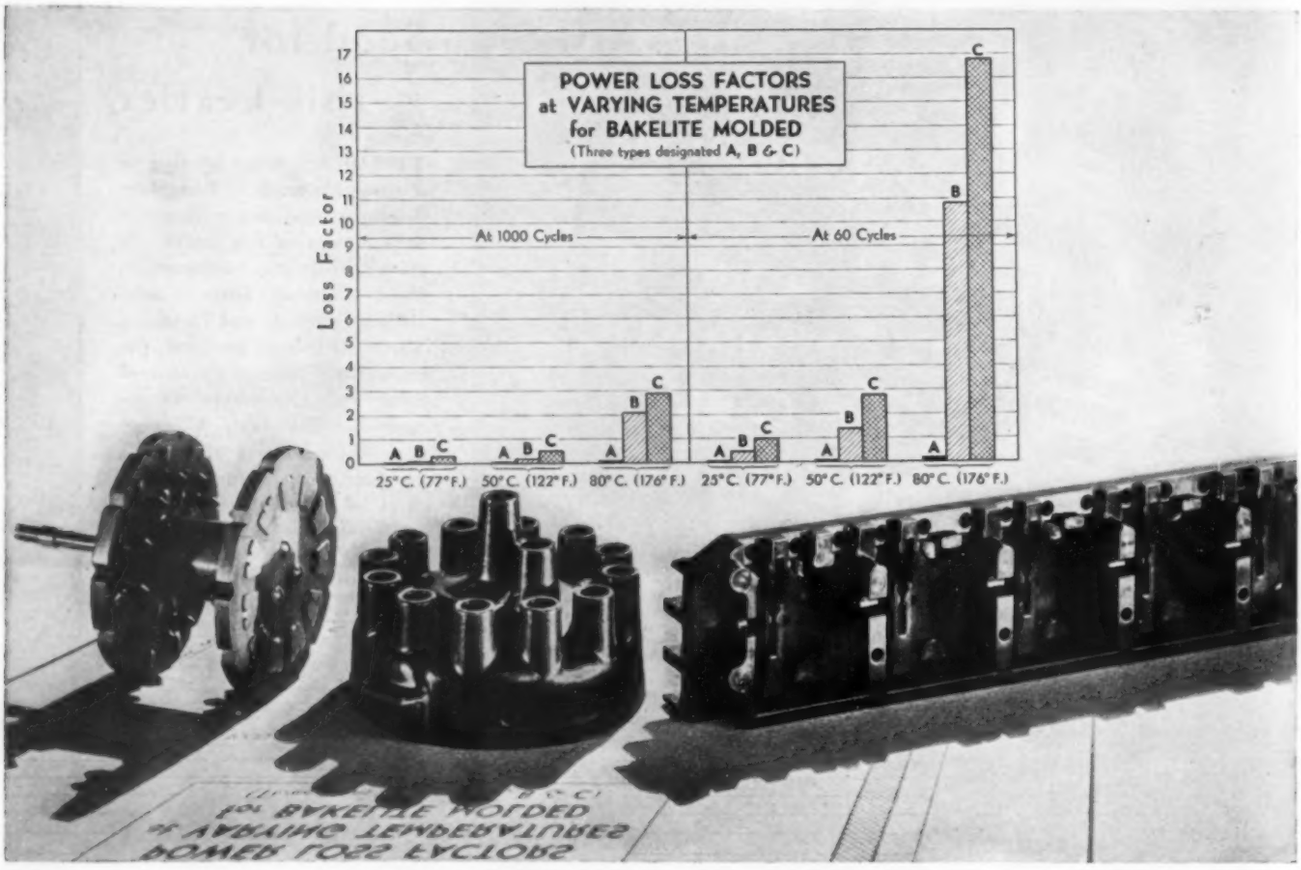
IF YOU are doing filtering or extraction work in laboratory determinations you will surely want a copy of this leaflet. It gives complete information about Alundum Discs, Cones, Dishes, Crucibles and Thimbles. These Alundum products are exceedingly popular because of their great resistance to reagents and solvents. Cleaning is a simple process of washing and igniting to constant weight. Send for your copy of the leaflet TODAY.

NORTON COMPANY,
Worcester, Mass.

THE complete line of Norton Laboratory Ware includes a wide variety of products for ignition, incineration and filtration. It is carried in stock by most laboratory supply houses and it is recommended that you purchase these materials through them. Norton Company will be glad to send a complete catalog of Alundum Laboratory Ware. No obligation.

R-551

Molded Parts that *Reduce Power Loss*



THE various temperatures at which any electrical device may be called upon to operate—and the variations in electrical frequency, as well—must be carefully considered in selecting dielectrics. Unless power loss of the material remains consistently low throughout the entire range of working temperatures and frequencies, practical efficiency of the device may suffer appreciable losses.

In Bakelite Molded, engineers and designers have available several different dielectrics with differing electrical properties. The diagram, reproduced above, shows a few critical values for the power loss factors of three types of Bakelite Molded. It indicates how well Bakelite Molded meets power loss requirements in nearly any practical range of temperatures and frequencies.

The numerous types of Bakelite Molded now available also provide similar useful variations in other important electrical, mechanical and chemical characteristics. Through proper selection, appropriate combinations may be obtained to meet countless needs of the engineering designer. Our engineers would welcome an opportunity to cooperate with you in determining the type of Bakelite Molded best suited to your needs.

At your request, we will be glad to mail you our illustrated booklet 23M, "Bakelite Molded" containing A. S. T. M. data and other useful information.

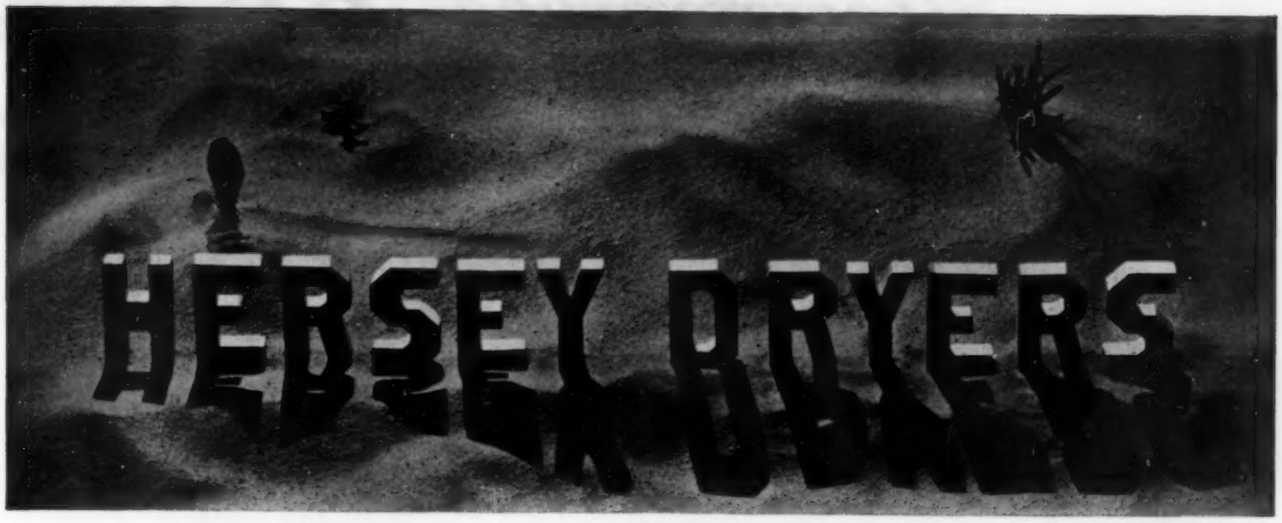
Visit Bakelite Booth No. 35 at the Annual Science Exhibition conducted by Amer. Assn. for the Advancement of Science, Atlantic City, Dec. 28th—Jan. 1st.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numeral sign for infinity, or unlimited quantity, it symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

THE MATERIAL OF A THOUSAND USES



SOME PRODUCTS DRIED BY HERSEY

Following is a partial list of products being successfully and economically dried in Hersey Dryers:

AMMONIA ALUM
AMMONIA HYDRATE
AMMONIUM CHLORIDE
AMMONIUM SULPHATE
BEET SUGAR
BONE BLACK
BICHROMATE OF SODA
BICARBONATE OF SODA
BORAX
CANE SUGAR
CHAR
CHALK
COFFEE
CORN FEED
CORN SUGAR
EPSOM SALTS
FORAGE
GLAUBERS SALTS
GLUCOSE & SUGAR MIX.
GRAPE SUGAR
HAY
MAGNESIUM SULPHATE
MEAL AND GRAIN
MILK SUGAR
POTASSIUM OXALATE
POTASSIUM NITRATE
POTATOES
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This is by no means the complete story of what Hersey Engineering can do, but illustrates the class of work to which Hersey Dryers have been already successfully adapted.

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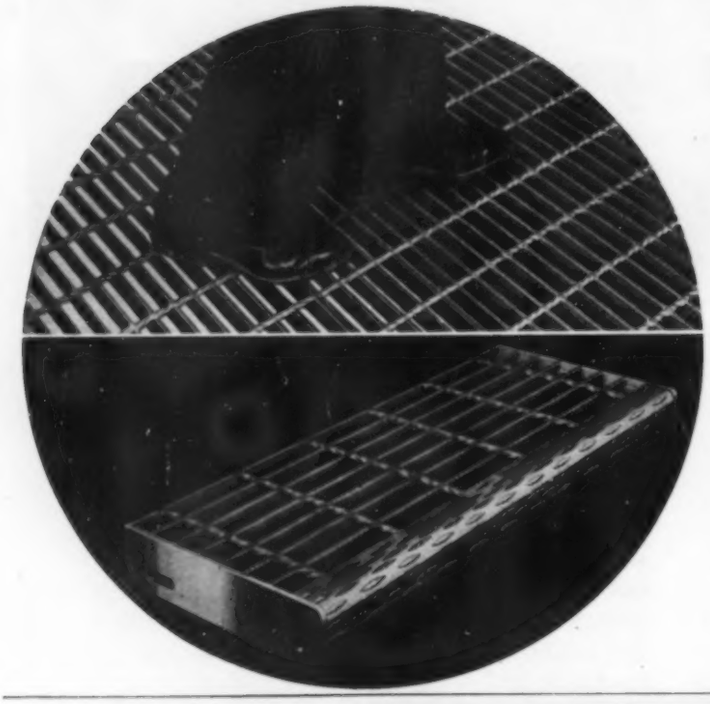

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NO RATTLES
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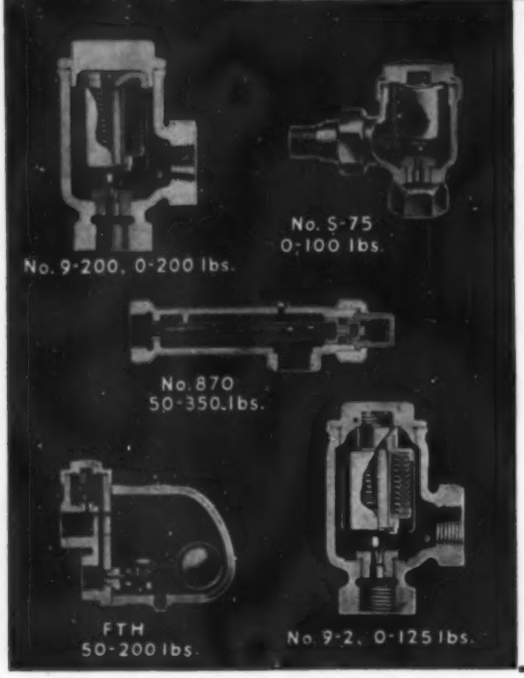

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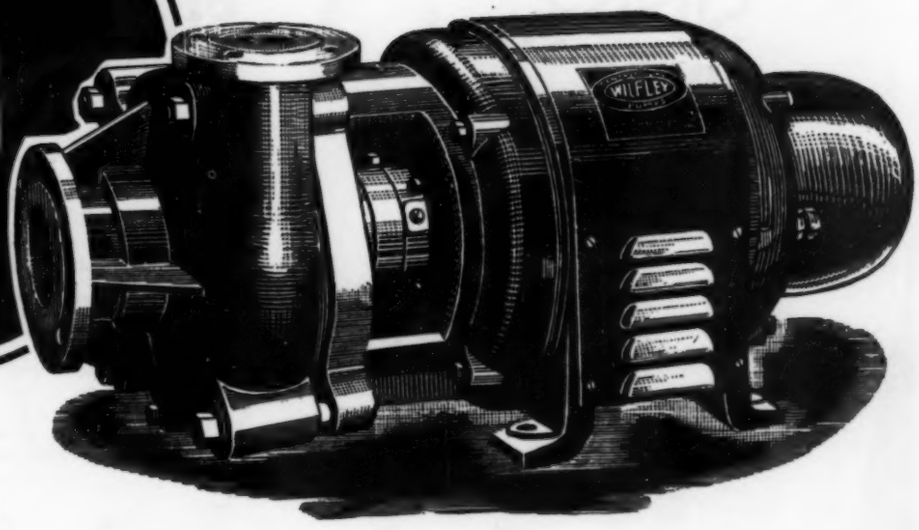

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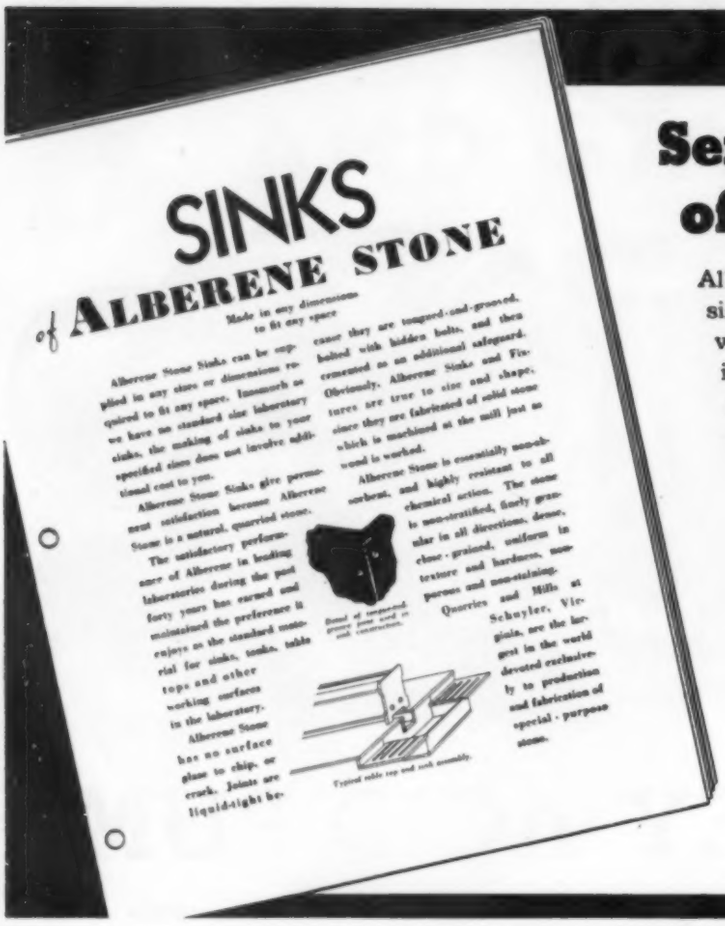
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Made in any dimensions to fit any space
Alberene Stone Sinks can be supplied in any sizes or dimensions required to fit any space. Inasmuch as we have no standard size laboratory sinks, the making of sinks to your specified sizes does not involve additional cost to you.
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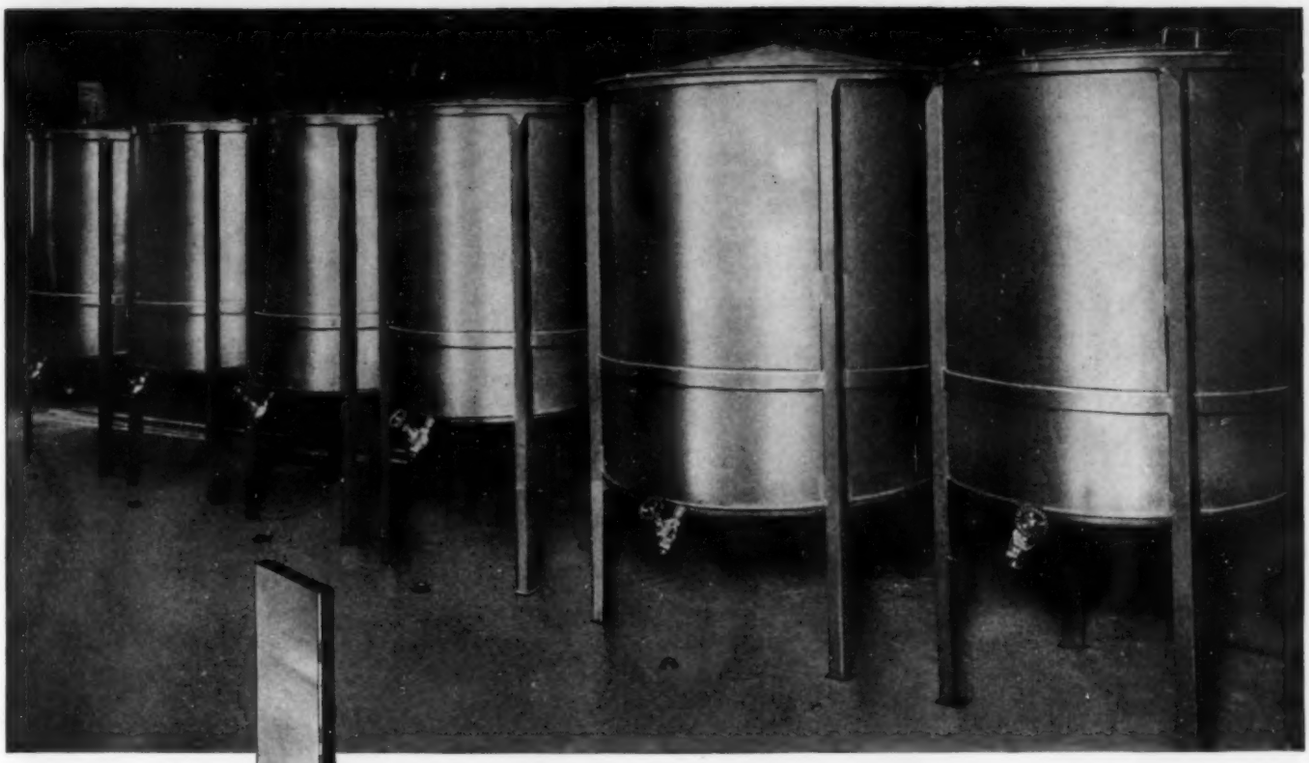

The Dr. Pepper Company of Dallas, Texas, uses these IngAclad kettles for mixing and processing. Fabricated by Sheet Metal Engineering Works, Chicago. Capacity of kettles, 330 and 500 gallons. 10 and 12 gauge IngAclad was used.

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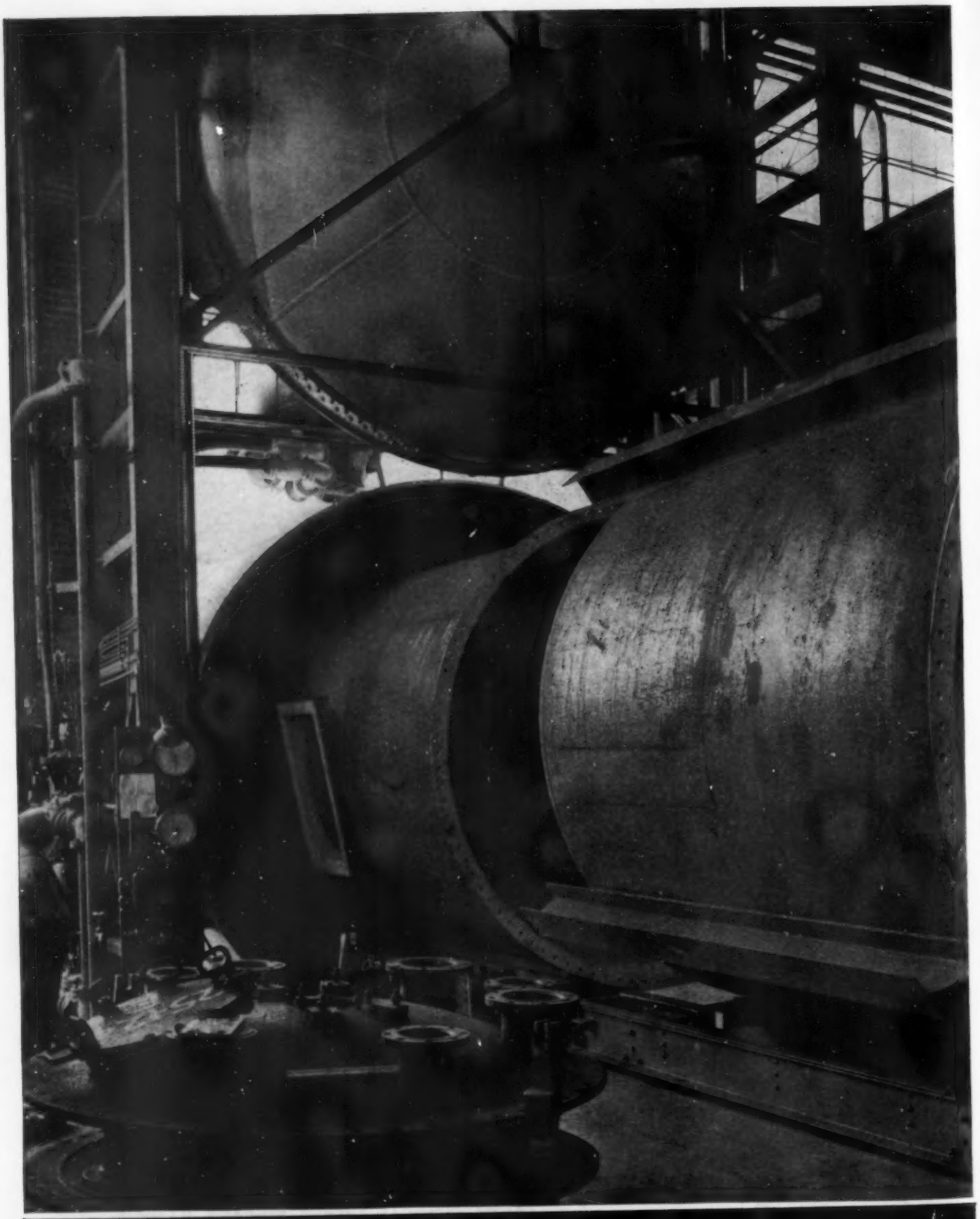

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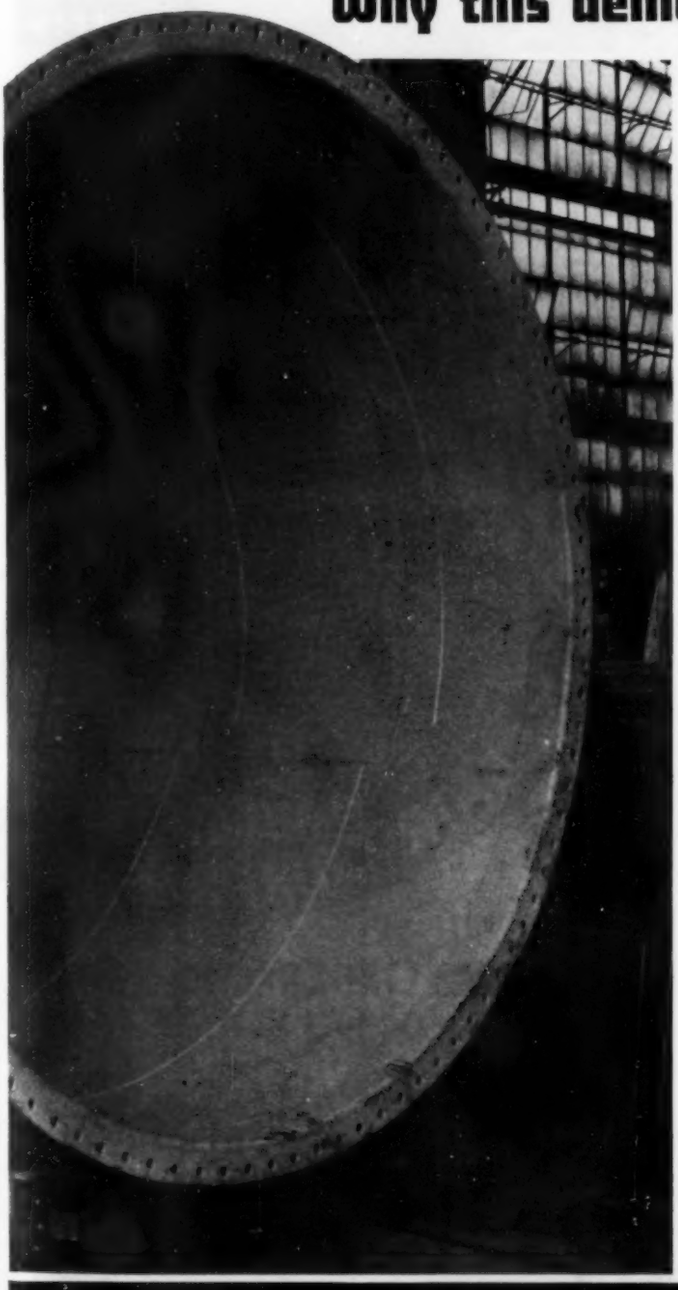
"Tanks a Million"

Take a look at the largest vulcanizer in the world. It has just been installed in the Goodrich plant as *additional* equipment to take care of the constantly greater demand for Goodrich-lined chemical tanks.

Why this demand? Five good reasons:



1—GOODRICH TANKS HAVE A RECORD OF PERFORMANCE. Goodrich has been making chemical tank linings for years and every one has proved a satisfactory, profitable investment for its owner.

2—GOODRICH LININGS NEVER CRACK. Patented expansion joints permit safe expansion and contraction of the rubber lining.

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4—GOODRICH LININGS ARE SPECIALLY COMPOUNDED. Goodrich can use the best rubber compounds and constructions for the particular solution to be handled or conditions to be met. We do not have to alter or adjust them in order to secure adhesion.

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Goodrich lining can be applied to tanks of almost any shape or size, and to pipe, valves, fans, agitators. Picture any of these, for your plant, going into this huge Goodrich vulcanizer. Out would come the safe solution to your chemical handling job. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio. (In Canada: Canadian Goodrich Company, Limited, Kitchener, Ontario.)

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The one thing remaining is for you to let us match our equipment against your needs—remembering that with "New England" equipment is included the *judgment* of Engineers who have made agitation their own specialty.

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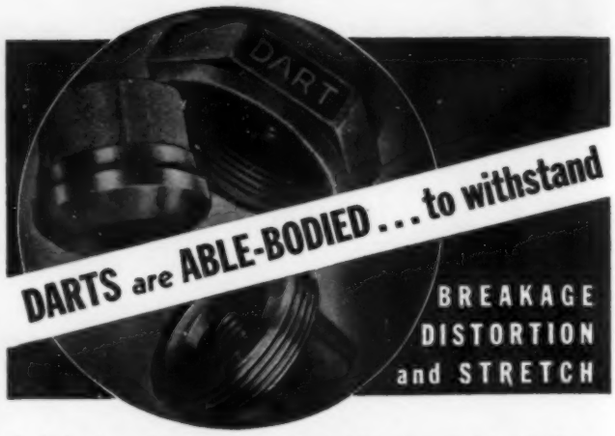

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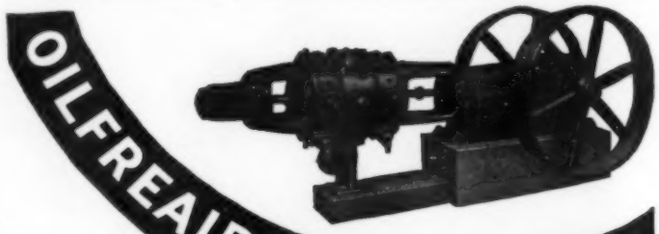

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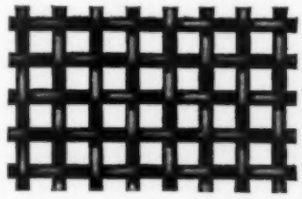
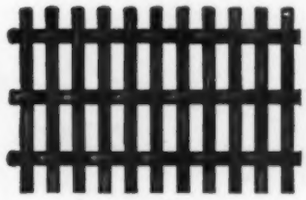


Square Mesh Wire Screen



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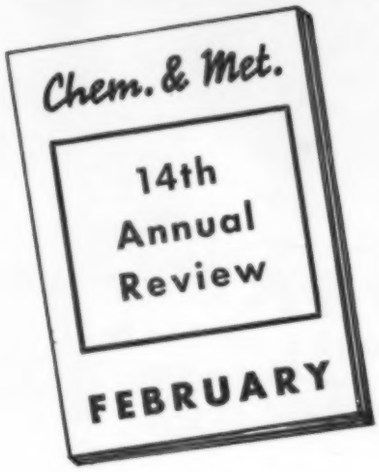

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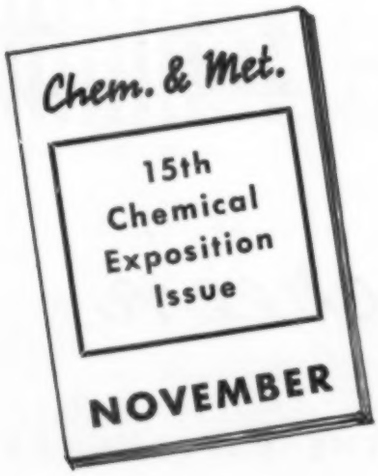

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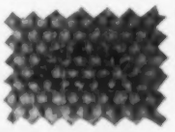

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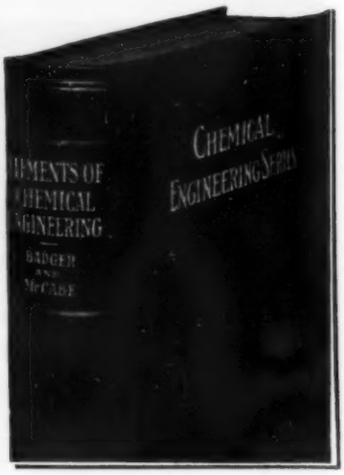

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Address .....

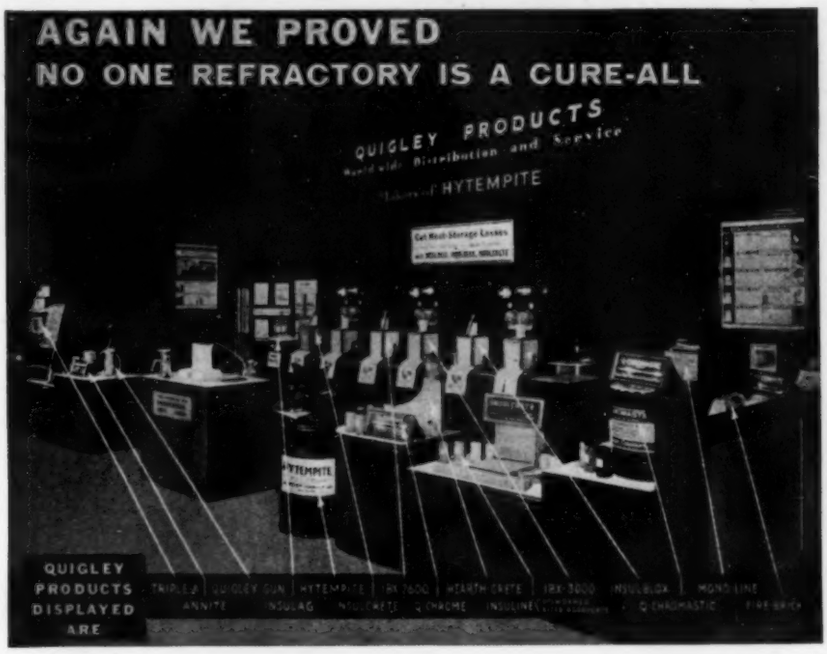
City and State .....

Position .....

Company ..... M. 12-36

THE QUIGLEY EXHIBIT WAS PRONOUNCED—

"Most Convincing Exhibit of the Show"



Why heat up 100 tons of refractories to produce twenty tons of material? Every furnace builder and operator is interested in this question. Every one acknowledges that low heat storage is a most important factor. The speed of a furnace in accommodating itself to fluctuations of temperature and load depends entirely on heat storage.

Are you heat storage conscious?

Do you know what low heat storage means to you in dollars and cents?

INSULINE PRODUCTS SHORTEN FURNACE DAYS TO SHORT WORK DAYS

QUIGLEY PRODUCTS which excited major interest at the Cleveland Heat Treaters' Show include—

INSULINE

Light weight, calcined, cellular, porous, insulating refractory of low heat storage capacity—used in dry, plastic or molded form, or shapes. This material is the base of all INSULINE Products including INSULAG, INSULBLOX, INSULCRETE, INSULBRIX, etc. INSULINE, due to its chemical and physical structure, imparts to these products higher refractoriness, exceptional insulating efficiency, strength, stability, no shrinkage at recommended temperatures.

INSULBLOX

Low heat storage refractory insulating blocks for backing up thin fire brick walls and roofs and for direct exposure up to 2200°F. INSULBLOX weighs 35 lbs. per cubic foot. 1" of INSULBLOX is as effective in insulating value as 10" of fire brick and has only 1/40th the heat storage capacity.

INSULAG

Plastic refractory insulator and gas tight sealer for service temperatures up to 2200°F. INSULAG expands after application and never shrinks. Its monolithic character, insulating properties and high refractoriness recommend it for backing up high temperature refractory walls in metallurgical furnaces, boiler and oil still settings, bubble towers, drums, smoke flues, stacks, etc. 1" of INSULAG is better than 9" of fire brick.

INSULCRETE

Light weight, cellular, castable insulating refractory, ideal for furnace linings, doors, floors, covers, special shapes, backing up, etc. No cutting, no fitting, just pour into place. 1" of INSULCRETE has an insulating value equal to 4" of fire brick with only 1/7th the heat storage capacity.

INSULINE INSULATING AGGREGATES

INSULINE Powdered is a finely crushed low heat storage refractory crystalline insulating powder for service temperatures up to 2600°F. 1" of INSULINE Powdered is equivalent to 7" of fire brick and is therefore used between the inner and outer walls of fire brick and monolithic construction. INSULINE Powdered weighs 58 lbs. per cubic foot.

Sized Aggregate—Crushed and carefully sized refractory aggregate used to reduce heat storage losses in furnace linings for temperatures up to 2600°F. as insulating fill between walls. 1" of INSULINE Sized Aggregate has an insulating value equal to 7" of fire brick. Weighs 47 lbs. per cubic foot. INSULINE Sized Aggregate mixed with proper proportions of Portland Cement and water is poured like concrete on the outside of thin fire brick walls. Recommended for open hearth furnaces, heat treating furnaces, boiler roofs, dry kilns, etc.

INSULBRIX 3000

Light weight, cellular insulating fire brick for direct or indirect exposure to flame and furnace gases, in boiler and other furnaces, ovens and kilns. 1" thickness of INSULBRIX 3000 is equal to nearly 3" of fire brick and has only 1/10th the heat storage capacity.

INSULBRIX 2600

Light weight, cellular insulating fire brick for direct or indirect exposure to flame and furnace gases. 1" of INSULBRIX 2600 has an insulating value equal to 5" of fire brick and has only 1/17th the heat storage capacity.

HYTEMPITE

The Standard of Comparison for High Temperature Cements. HYTEMPITE is a plastic air setting cement for laying fire brick with thin, strong, tight joints. HYTEMPITE lays more brick and forms a bond all the way through the joint.

Q-CHROME

A neutral base refractory cement for severe service duty. Q-CHROME is used for laying fire brick, chrome, magnesite and other refractory brick in all types of furnaces where extremes of temperatures, chemical and physical actions are encountered.

Q-CHROMASTIC

Plastic super-refractory surfacing material. Used as a veneer coating over new or old furnace walls and arches to resist slagging action, flame, corrosive gases and abrasion.

MONO-LINE

Plastic first quality fire brick. In easy-working form for building complete monolithic linings.

CAST-REFRACT

Castable refractory which is cast or molded into any desired form and sets quickly with great structural strength. Recommended for special shapes, burner blocks, door linings, etc.

HEARTH-CRETE

Neutral chrome base castable refractory for building monolithic bottoms in forging and heat treating furnaces; for repairing tap holes in open hearth furnaces; for patching side walls in copper reverberatory furnaces; for fill and facing in boiler furnaces, water walls; and for casting burner blocks and special shapes.

QUIGLEY REFRACTORY GUN

Used for scientific mechanical applications of refractories in plastic form. The QUIGLEY GUN will repair a whole battery of furnaces in the time formerly required to repair one.

QUIGLEY SPECIFICATION FIRE BRICK

Made in many grades of various chemical and physical characteristics to meet general and special requirements.

TRIPLE-A PROTECTIVE COATINGS

For protecting steel structures against corrosion due to heat, moisture, acid or alkaline fumes.

ANNITE

Industrial cleaning materials for efficient and economical removal of dirt; for industrial or process cleaning operations.

QUIGLEY COMPANY INC.

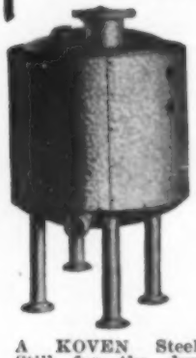
Manufacturers of Industrial Specialties

56 West 45th Street, New York

Distributors with Stocks and Service in Important Industrial Centers throughout the United States, Canada, and in 32 other countries.

IN CANADA, QUIGLEY COMPANY OF CANADA LIMITED, MAIN OFFICE AND FACTORY, LACHINE, P. Q.

IF a manufacturer could follow his product into a consumer's kitchen—



A KOVEN Steel Still for the dry cleaning industry.

—Would he see his product receive the smiling approval of a good cook? Or would it be frowned upon and never bought again because it was tainted in taste and color?

Don't take such a chance with your product and your business. You might have equipment that is inefficient and corroded—that creates huge spoilage cost, slows up production and taints and discolors your products. This sort of equipment can make your business unprofitable and will continue to do so until you get rid of it.

Give serious thought to this problem. Call in a KOVEN engineer and discuss it with him. KOVEN has been designing, manufacturing and installing modern efficient equipment for the process industries for over 50 years. Equipment in all commercial and non-corrosive metals built to your specifications. Let KOVEN help you solve your problem. KOVEN men know their job. Call upon them. It obligates you in no way.

A KOVEN Stripping Machine.

A few of the many KOVEN products are: pressure vessels, extractors, mixers, stills, condensers, kettles, tanks, chutes, bins, containers, stacks, piping coils, etc.

L. O. KOVEN & BRO. INC.

154 Ogden Ave. Jersey City, N. J.

LARGE OR SMALL • IF KOVEN MADE • IT'S WELL MADE

OLIVER CONTINUOUS (VACUUM)

OLIVER PRESSURE (BATCH)

OLIVER PRESSURE (CONTINUOUS)

OLIVER-ROBISON

TOP FEED

OLIVER-CAMPBELL

OLIVER-GENTER

12 DIFFERENT FILTERS

OLIVER PRECOAT

KELLY

DORRCO

SWEETLAND

AMERICAN

Three Oliver Precoat Filters in a prominent New Jersey chemical plant.

Consider carefully what this wide selectivity of principle and type means to you with a filtration problem on your hands! It's a service to you that cannot even be approached elsewhere. It shows conclusively that Oliver United is specializing not merely in making filters but in applying filtration effectively.

Coupled with this wide selectivity is an experience in filtration and clarification that goes back some thirty years and covers every process industry.

By coming to Oliver United, you are assured of getting the right type of filter for your particular problem. You have the widest choice. You get the most experienced engineering.

OLIVER UNITED FILTERS INC.

33 West 42nd Street
New York, N. Y.

221 N. LaSalle Street
Chicago, Ill.

351 California Street, San Francisco, Cal.

For 20 Years-

The unusual heating problems of industry have been handled by Merrill Hot Oil Systems. Old-fashioned Direct-fire methods resulted in uncertain quality and localized over-heating.

Steam—at 150 lbs. pressure—was actually too cold for many process demands. Even 200 lbs. wasn't enough.

Other means were tried, but proved either too slow or unreasonably expensive.

The MERRILL PROCESS System of Industrial Heating by Oil Circulation delivers heat at a controllable rate for guaranteed quality, properly distributed for uniform heating, at temperatures high enough for the work — but not too high to scorch the product. And it is done almost *without pressure* as the system is actually vented to the atmosphere.

Submit *your* high temperature process problems for careful study and recommendations. No obligation.

PARKS-CRAMER CO.

Engineers and Contractors

1104 Old South Building · Boston, Mass.

MERRILL PROCESS

Low Pressure
High Temperature

PROFITS

for Pioneers!

Be the first in your field to enjoy the benefits of Exolon SUPER-separation, and reap the profits of pioneering! Your product may be improved—its processing made less expensive—with the Exolon High Intensity Magnetic Separator. We don't promise to work miracles, but we do say the Exolon Separator has, and can in many cases

1. Give you a better product.
2. Secure a higher percentage of usable (or saleable) product from your raw materials.
3. Lower your production costs, by eliminating or simplifying complicated chemical or mechanical processes.

All of these advantages have a real cash value to you, and make it worth your while to find out for sure if your product can be benefited by Exolon SUPER-separation. A production test in our laboratory, at nominal cost, will tell the story. Take the first step today by writing for Bulletin K-2, giving details of tests and specifications of equipment.

FACTS
which make the Exolon Separator OUTSTANDING IN ITS FIELD!

SCOPE . . . far greater than ordinary separators. Exolon SUPER-separation has brought about an entirely new conception of the possibilities of magnetic separation since its introduction eight years ago. Many materials which formerly were considered non-magnetic, for all practical purposes, have since been found to lend themselves perfectly to SUPER-separation by the Exolon process.

ECONOMY . . . requires less than 200 watt hours per ton of head feed to energize coil. Careful construction keeps repair and maintenance expense to minimum. Exolon "pay-as-you-use" plan provides guaranteed performance at guaranteed low cost.

CAPACITY . . . adequate to meet all industrial requirements, depending only on size of installation.

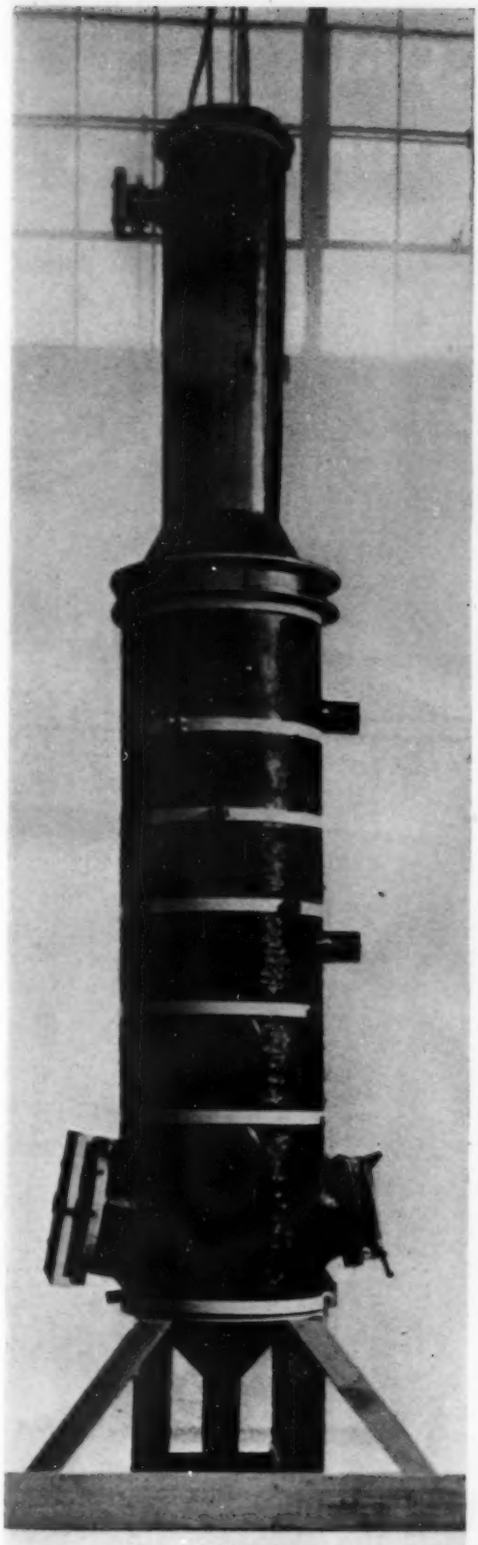
CONTROL . . . so simple and positive that any of your workmen who can read figures can obtain absolutely uniform results day after day.

CONSTRUCTION . . . to high precision standards, so simple and strong that maintenance is kept to a minimum, and results maintained at uniform high level.

EXOLON

Magnetic Separator

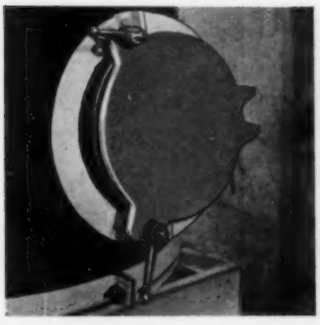
THE EXOLON COMPANY • BLASDELL, N. Y.



HAVEG

LENDS ITSELF READILY TO SPECIAL CONSTRUCTION

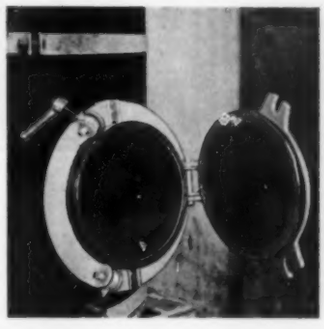
★ ★ ★



Haveg equipment is molded in large units without seams or joints. It readily lends itself to economical production of special forms and shapes. Haveg is a phenolic resin asbestos composition and is, therefore, impervious to chemical attack throughout its entire mass.

The accompanying illustrations show a 3′ dia. Haveg tower with cone bottom and a quick-opening door that is rather unusual.

Haveg is adaptable as well as light-weight, mechanically strong, not readily chipped or fractured, indifferent to rapid temperature changes, rugged and long-lived. Let us tell you more about "The Equipment that Defies Corrosion" — Show you how Haveg Equipment can save money for you. Write us.



HAVEG CORPORATION

NEWARK, DELAWARE

1453 Leader Bldg., 526 Superior Ave. CLEVELAND, OHIO

2100 North Racine Ave. CHICAGO, ILL.

Edison Bldg., 601 West 5th St. LOS ANGELES, CALIF.

H A V E G

THE TIME HAS COME, THE WALRUS SAYS, TO THINK OF . . .

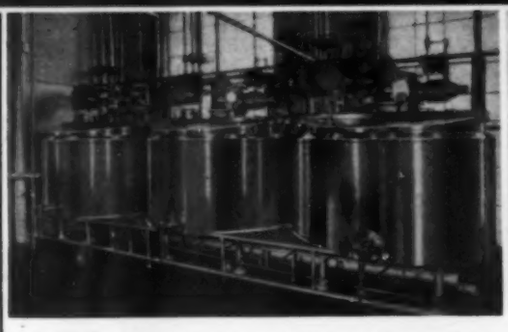
INVITATION

MR. FABRICATOR: Without any doubt, the next few years (even months) will see many new types of equipment, perhaps some of them competitive with your own, made stronger and more corrosion resistant and more productive . . . through the skillful use of USS Stainless Steel.

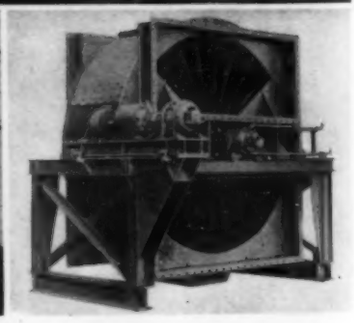
Fabricators who wish to investigate, today, the possibilities of improving their product with USS Stainless Steel are invited to write our nearest District Office. They may write freely, in full confidence, with no subsequent obligation.

Their inquiries will receive the attention of stainless steel specialists of wide experience in many fields—and, if necessary, be investigated in laboratories where the most advanced equipment is available to study any problem for which the answer is not already known.

Make no mistake — the trend to USS Stainless Steel has just begun. Many opportunities remain to be explored.



TANKS, PIPING, *valves, and supports — this pasteurizing equipment is completely made of USS Stainless Steel. Since there is no known limit to the useful life of USS Stainless Steel, these tanks will look "brand new" forever!*



CORROSIVE GASES *at 1400° F. have no lasting effect on this efficient pre-heater. It is made largely of heat-resisting USS Stainless Steel.*

THROUGH TUBES *and valves of USS Stainless Steel, this mayonnaise plant pipes vinegar and salad oil from storage to mixing. Just compare the cleanliness, simplicity and lowered production cost of this setup as against the older methods of batch handling and pouring!*

Stainless Steel

For railroad trains and air-o-planes
And ships with stainless keel
For boudoirs, beds and valve-in-heads
For plaques and plats and platters
For water gates and dental plates
And other wondrous matters . . .

The Walrus and the Carpenter, as seen in *Alice Through the Looking Glass*, talking "of many things; of shoes and ships and sealing-wax . . . And whether pigs have wings."

JUST a few years ago, stainless steel was thought of only in connection with cutlery.

Then some questioning chemist wondered why better mixing tanks could not be made of stainless steel . . . and his production manager found that stainless steel mixing tanks required less time-out for cleaning, speeded up production, turned out a purer product with no trace of metallic contamination.

An inquisitive petroleum engineer wanted to try higher temperatures and pressures . . . so he designed a new cracking still using seamless tubes of heat-resisting stainless steel and increased his yield of gasoline.

A mayonnaise maker questioned the cost and waste and spoilage of batch handling and pouring . . . so he just eliminated them by piping his vinegars and oils directly from storage to mixing through impervious stainless steel pipes and valves. Now his mayonnaise costs less to make!

Before long, all kinds of plants began using all sorts of better equipment made with this wondrous new metal. But the important fact is that practically every experiment with stainless steel has been an outstanding success.

Even more important are the opportunities still undeveloped. In the days ahead, there will be more successful developments in USS Stainless Steel which will earn money and fame for the people who make them.

The Walrus is righter than he thinks. The time *has* come when every manufacturer—whether he sells soap or soup or milk or dynamite—should investigate the improvements and savings now possible with USS Stainless Steel equipment.

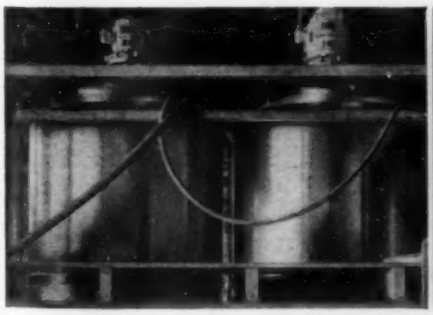
SUGGESTION

MR. BUYER: For chemical plant equipment, USS Stainless Steel closely approaches "the perfect metal." In countless applications, equipment made of this brilliant new metal is *permanent;* it effectively resists every destructive force of nature — stress, wear, corrosion, heat, and time itself.

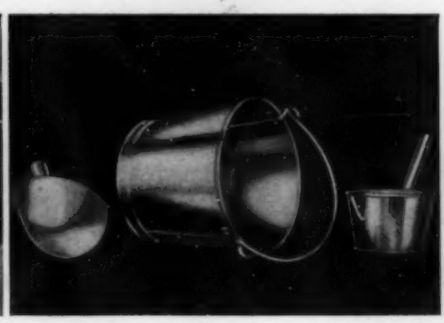
Whenever you are considering any important purchase, we suggest you investigate the possibility of getting a better piece of equipment made wholly or partly of USS Stainless Steel. Almost without exception, the equipment which benefits through the unusual properties of USS Stainless Steel will last longer, cost less for maintenance, turn out a purer, more saleable product . . . give you more value per dollar spent.

Our nearest District Office will be glad to recommend competent fabricators skilled in making better equipment of USS Stainless Steel.

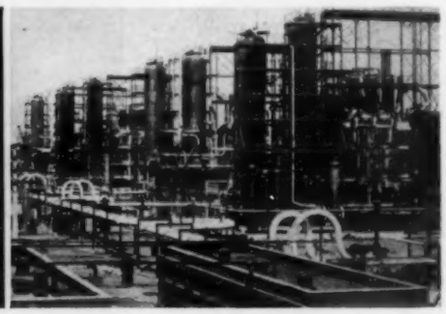
Remember that in many applications there is no known limit to the useful life of USS Stainless Steel; it will stay "brand new" forever!



THESE VERSATILE *mixing tanks of USS Stainless Steel will handle an almost unbelievable variety of corrosive chemicals. They speed up production because they require less time-out for cleaning.*



EVEN PAILS, *scoops and dippers are better when made of USS Stainless Steel. They clean easily and stay cleaner. They are so strong they wear indefinitely. Their longer life quickly liquidates their cost.*



HIGH TEMPERATURE *cracking stills of USS Stainless tubing increase the yield of gasoline, reduce cost of making it. Wherever higher temperatures or pressures will increase yields, try USS Stainless Steel.*

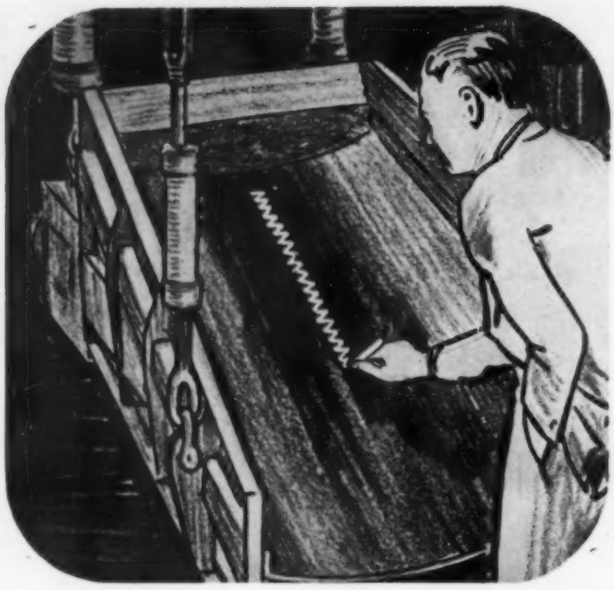
U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

The ∿∿∿ Line To Profits With . . .



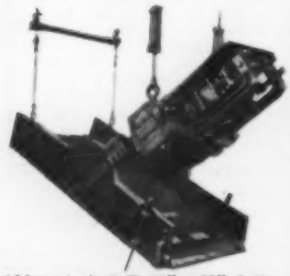
Jeffrey-Traylor Equipment

We call it "the saw-tooth line to profits" . . because a chalk line drawn on the side of any Jeffrey-Traylor electric vibrating equipment in operation, results in a fine jagged line. Vibration does this, and the same vibrations cause handled material to flow forward . . uphill or down. Yet there is no visible movement of the deck or screen.

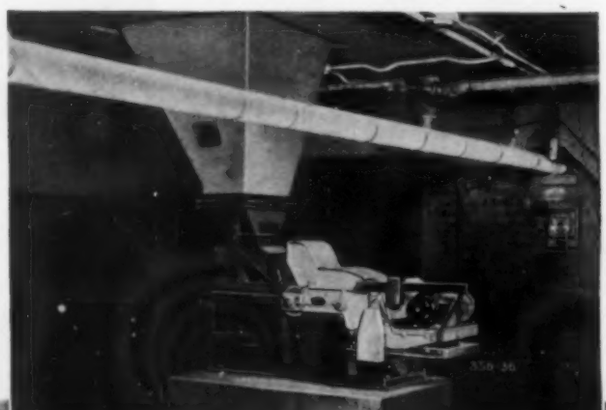
All J-T Equipment is suspended or supported on shock absorbers . . so no vibration is transmitted to plant structure. The basis of Jeffrey-Traylor patented Units is BALANCED HIGH FREQUENCY VIBRATION under ABSOLUTE CONTROL. Electricity causes and controls the vibration.

To all industries we offer a series of J-T units . . units which are revolutionizing material handling operations, for feeding, conveying, screening, barrel-packing, cooling, drying and other processes . . units through whose agency many plants have already effected distinct economies.

Send for the complete Jeffrey-Traylor Catalog No. 620.



(Above) A J-T 30" x 68" fully adjustable electric vibrating Conveyan-screen. Furnished in single or double deck styles—used for scalping and screening raw and finished materials in process industries.

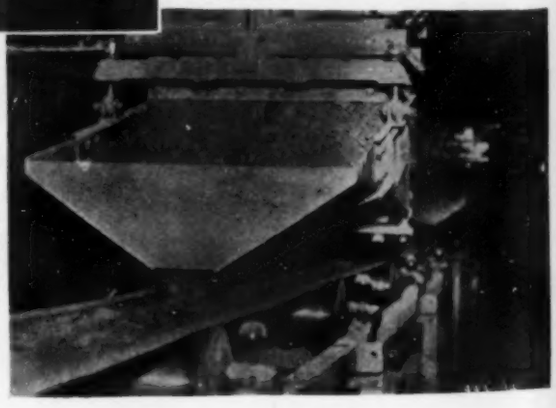


(Above) A Jeffrey-Traylor open Pan Feeder 36" x 36". There is a type and size Feeder, pan or tubular style, for any feeding requirement you may have.

(Left) A Jeffrey-Traylor Constant Weight "Waytrol" for controlling feed to grinding mills, etc., for proportioning and batching . . . all these processes by exact weight rather than volume.

(Left) A Jeffrey-Traylor Water Jacketed Tubular Feeder feeding batch to glass furnace. Positive control over tonnage is assured with J-T Feeders.

(Right) Proportioning and feeding raw material beneath silos in a large Cement Plant with Jeffrey-Traylor electric vibrating Feeders.



THE JEFFREY MANUFACTURING COMPANY

909-99 North Fourth Street

Columbus, Ohio

ALLEGHENY

THE TIME-TESTED

STAINLESS STEELS

FOR EVERY HEAT AND CORROSION RESISTING SERVICE

ALLEGHENY METAL

18% chromium—8% nickel stainless steel, combining maximum resistance to corrosion with ease of fabrication, strength, and permanent beauty of surface.

ALLEGHENY 22

A stainless steel of higher chrome-nickel content, affording increased resistance to chemical corrosion and heat, combined with ease of fabrication.

ALLEGHENY 44

Still higher in chrome-nickel content, stainless steel of great strength and workability . . . resists oxidation up to 2000°F.

ALLEGHENY 46

4% to 6% chromium stainless steel. Strong at elevated temperatures. Easy to fabricate. Oxidation resistant up to 1200°F., also corrosion resistant. Can be supplied in modified analysis.

ALLEGHENY 33

12% to 14% chromium stainless steel, amenable to heat treatment, possessing high impact values and resistance to abrasion. Resists oxidation up to 1500°F. Can also be offered as a modified non-hardening type.

ALLEGHENY 66

16% to 18% chromium stainless steel, similar in nature to ALLEGHENY 33, but more highly corrosion and heat resistant. Offered in a modified, non-hardening type.

ALLEGHENY 55

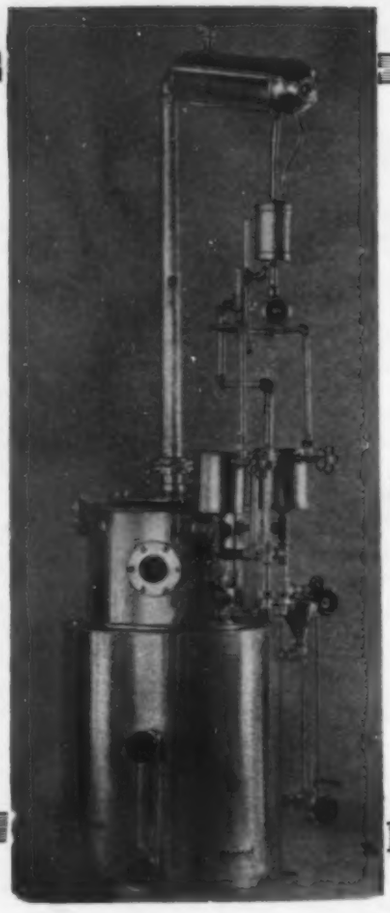
23% to 30% chromium stainless steel, resisting oxidation up to 2150°F. Excellent for installations not involving difficult fabrication.

ALLEGHENY STEEL CO.

BRACKENRIDGE PENNSYLVANIA

Sales Offices and Warehouse Stocks in the Principal Cities . . . Stocks carried by JOS. T. RYERSON & SON, INC. WAREHOUSES . . . Union Hardware & Metal Co., Los Angeles . . . American Brass & Copper Co., San Francisco—Oakland

(Allegheny Metal is licensed under Chemical Foundation patents Nos. 1,316,817 and 1,339,378)



EVERY TIME IT'S USED IT'S FRESH . . . *but It's The Same Old Solvent All The Time*

Here's how a pyrometer manufacturer cut his solvent costs to practically nothing and at the same time stepped up his cleaning process. With a Barnstead solvent recovery still his used cleaning solvent is automatically distilled back to its original freshness. His solvent is always fresh—always 100 per cent efficient—yet he uses the same solvent over and over.

In hundreds of other plants Barnstead Recovery Stills are making unusual cuts in new solvent costs. By making practically any old solvent just as good as new for as little as ½ cent a gallon, they actually pay for themselves within a few months.

Even if you use as little as 15 gallons of solvent a month, you can make substantial savings with a Barnstead Recovery Still. They are low in cost—easy to operate—and made to meet practically any requirement.

Send for bulletin.

The still shown at the left is equipped with two baths specially made for cleaning a sensitive pyrometer mechanism. Let Barnstead solve your problem.

TRADE MARK REG. U.S. PAT. OFF.

Barnstead

STILL & STERILIZER CO. Inc

4 LANESVILLE TERRACE, FOREST HILLS, BOSTON, MASS.

RYERSON STEEL

in Stock for Immediate Shipment

Large and complete stocks of all steel and allied products. Quick personal service is assured.

Structurals	Tees and Zees	Strip Steel, Flat Wire
Channels, Angles	Heat Treated Alloy	Mechanical Tubing
Hot Rolled Bars	Steel Bars	Boiler Tubes and
Hoops and Bands	Stainless Steel	Fittings
Plates, Sheets,	Cold Finished	Welding Rod
Alloy Steels	Shafting	Nuts, Washers
Tool Steels	Screw Stock	Reinforcing Bars, etc.

WRITE FOR THE RYERSON STOCK LIST

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Detroit, Cincinnati, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

SUBMIT YOUR PUMP PROBLEMS DIRECT

TABER

SPECIAL PUMPS

Taber has long been recognized as headquarters for sound, co-operative pump development in the chemical and processing industries. Taber recommendations are always made to meet specific conditions. You will find the Taber organization keenly interested in whipping your pump problem. ● Fig. 603-C above shows a Taber Evaporator Pump that has the added feature of a "water chamber" surrounding the extra deep stuffing box under high vacuum. This prevents air from leaking into the evaporator. Taber Pumps may be had in all standard metals and castable alloys. Write for Bulletin G-631.

TABER PUMP CO.

294 Elm Street • Buffalo, N. Y.

Est 1859
Pumps to suit
The Service-

5948

500 INDUSTRIAL PROCESSES WERE

Just Good Ideas

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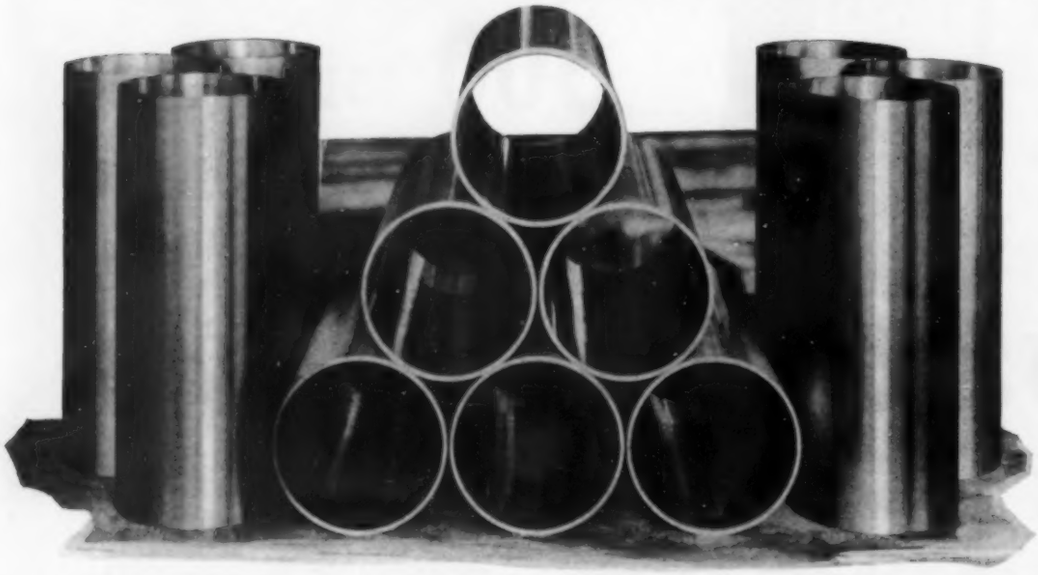

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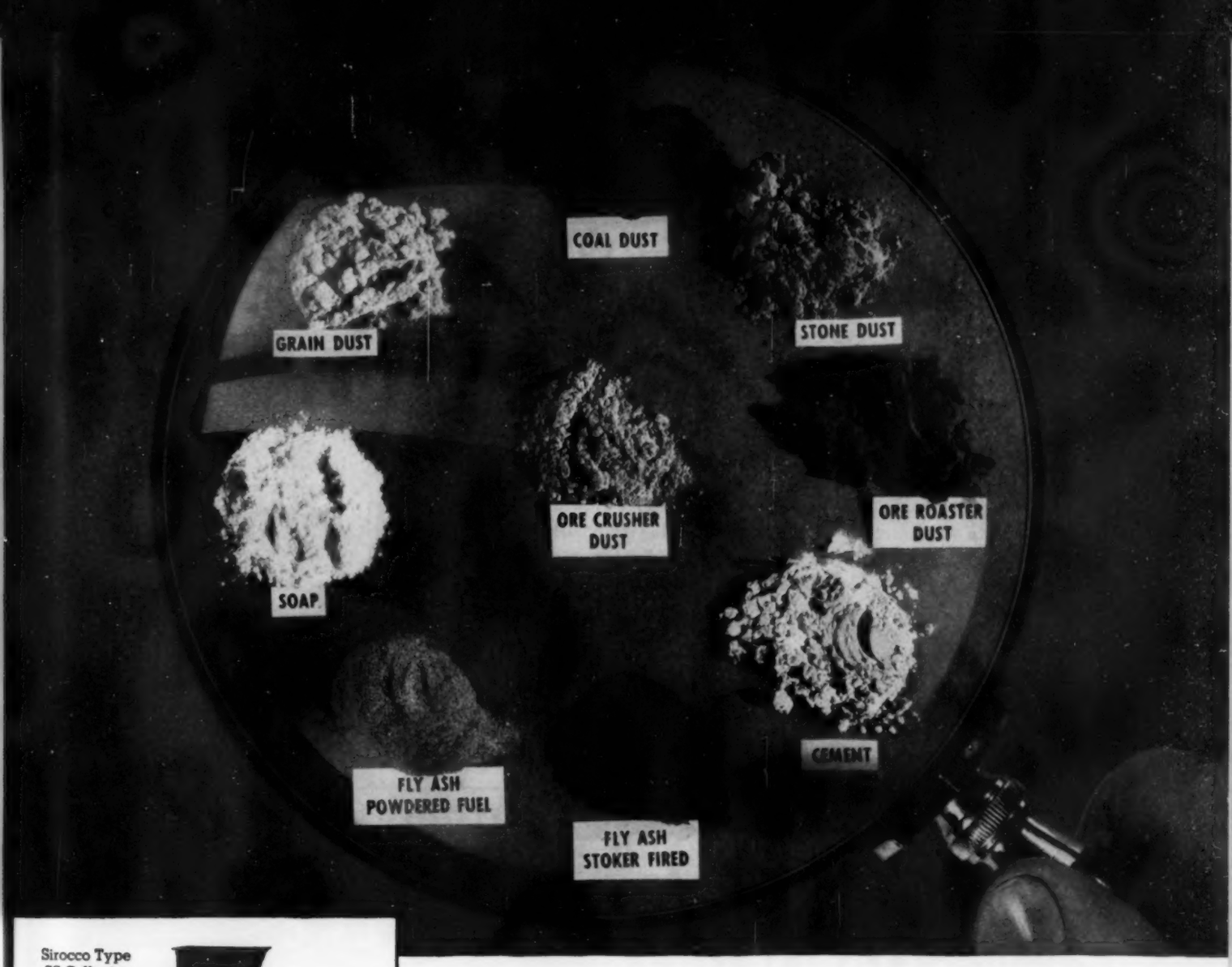

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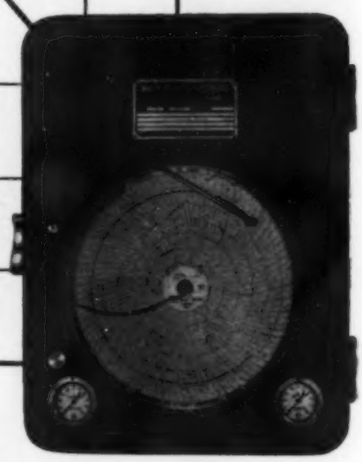

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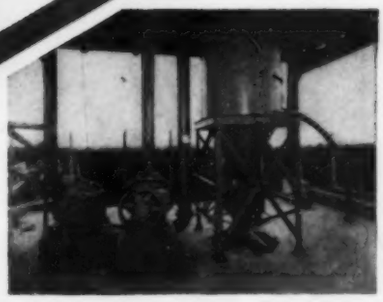

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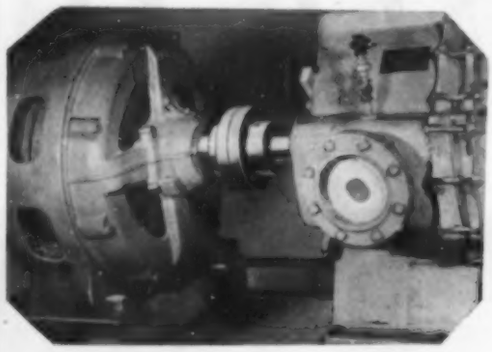

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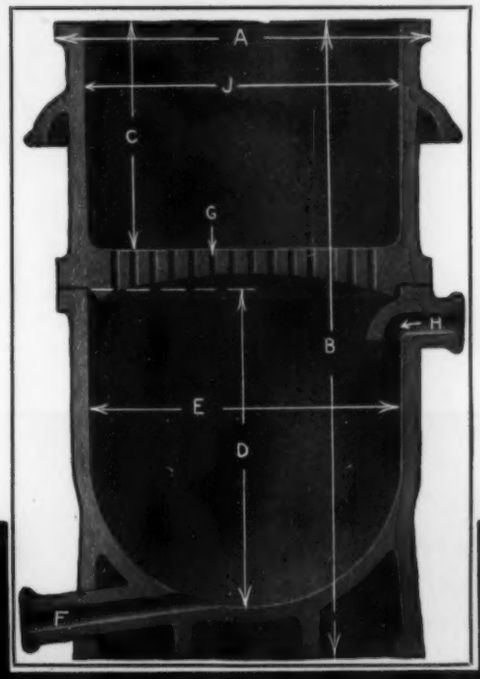
Write for Bulletin No. 410 for data on Suction Filters Acid-Proof Tanks, Jars, Etc.



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1936 Mobilization *for* Human Needs

Here is an opportunity for all good neighbors to join in a common cause which knows no party lines

Now is the time for all good citizens to come to the aid of their less fortunate fellow men

Despite government relief programs, millions of Americans—children, old folk, mothers and fathers—must look to the welfare agencies in their communities for assistance. In time of sickness or despair, they are dependent upon this neighborly aid.

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Give your share. Take part in the Community Chest or welfare association work in your town. No national fund is being raised; each community has full control of the funds it collects.

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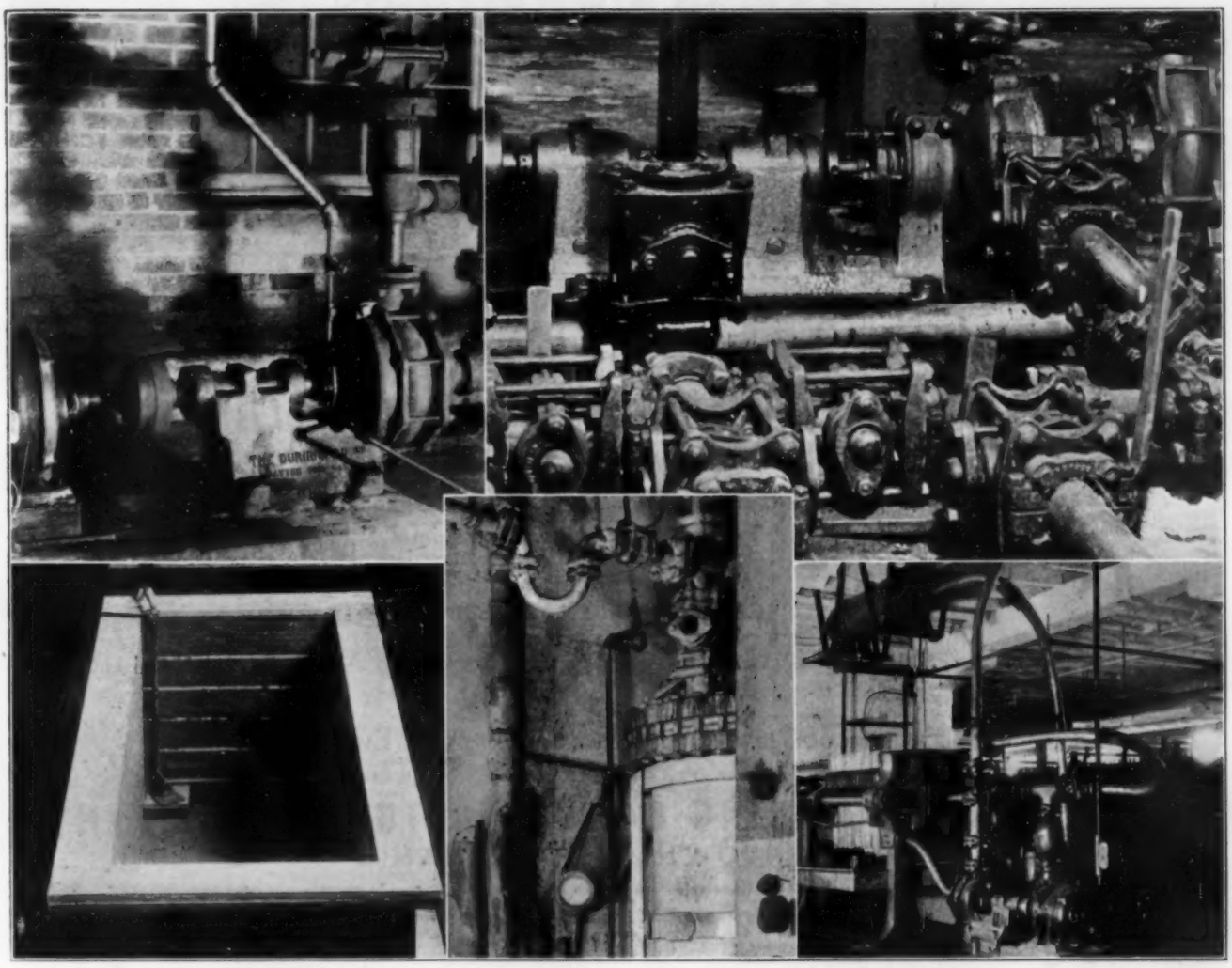

Upper left: Duriron 2G pump handling 250 g.p.m. of calcium hypochlorite bleach. *Upper right:* Duriron pumps, valves, pipe, fittings, circulate distillate and cider vinegar over generators. *Lower left:* Duriron circulating steam jet and Duriron siphon in pickling tank. *Middle:* Duriron kettle, valves, pipe, fittings used for essential oils and aromatic esters. *Lower right:* Duriron pumps, valves, heat exchanger handling plating solutions.

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Write today—there may be ways we can be of help.

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2—40" Cresson-Morris bronze basket **Centrifugal Extractors,** motor driven, complete with mixers.

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2—Buffalo 5'x12' **Rotary Vacuum Drum Dryers,** one iron drum, one bronze drum, complete with receivers, pumps and piping.

8—**Werner & Pfleiderer Mixers,** size 30, 2650 gal. working capacity each, jacketed. These are in excellent condition and must be moved quickly.

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1—J. P. Devine 5'x33' **Rotary Vacuum Dryer,** complete.

4—Aluminum 500-gal. closed **Jacketed Agitated Kettles.**

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1—Swenson Aluminum **Triple-Effect Evaporator,** 570 sq. ft. per effect.

1—Kilby 7' Calandria **Vacuum Pan,** copper coils.

1—Lummus Copper 500-gal. **Jacketed Vacuum Pan.**

2—6'x4', 8'x8' **Oliver Filters,** steel drums.

8—**Sweetland Filters,** Nos. 12, 11, 10, 9, 7, 5, 2, and laboratory size — copper, iron, and monel leaves.

12—**Distillation Units,** 72 in., 60 in., 54 in., 48 in., 36 in., 30 in., 24 in., 14 in., complete with dephlegmators, condensers, and still pots.

8—**Raymond Pulverizers,** No. 0000 to No. 3; three and five roll high side roller mills.

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Brand new Tolhurst 60" bronze basket extractors, copper lined casings, Texrope drives from 2-speed, 3 hp. G.E. Motors and push-button starters.

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SPECIALS

10—**Devine Vacuum Shelf Dryers,** No. 0, No. 5, No. 11, No. 12, No. 23, No. 26, No. 27, No. 30.

9—**Rotary Vacuum Dryers,** 2x4 ft. Devine; 2x6 ft. Stokes, Devine; 3x10 ft. Buffalo; 3x15 ft. Devine Stokes; 3x25 ft. Devine; 5x15 ft. Buffalo; 5x25 ft. Devine; 5x33 ft. Devine, complete.

1—**Atmospheric Drum Dryer,** 5x12 ft.; 1—Mechanical 4x9 ft.; 1—Devine 4x9 ft. dbl. drum; 1—Buffalo 48" x 40'.

16—**Aluminum Heavy Gauge Jacketed Kettles,** 52" dia. x 26½" deep, iron stands. Tested for pressure.

8—**Rotary Dryers,** direct heat, 3x20, 4x20, 5x26, 5x30, 6x 40, 8 ft. x 60 ft.

14—**Rotary Dryers** — Ruggles-Coles Class A, 3x10, 4x20, 5x26, 6x35.

8—**Hardinge Conical Mills,** 4½ ft. x 16 in., 5x22, 6x22, 7x 36, 8x30.

4—Buffalo 5'x30' monel lined **Rotary Dryers.**

1—5'x30' indirect heat **Rotary Dryer.**

6—Closed jacketed glass lined **Kettles;** 3—200-gal., 3—100-gal.

4—**Copper Vacuum Pans,** jacketed, 50, 100 and 500 gal.

12—**Vibrating Screens,** 2 x 4, 3x5, 4x5 Tyler; 2x3, 2x4, 3x6 Niagara; Nos. 9, 52, 61 Rotex.

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3—26 in. **Tolhurst Centrifugal Extractors,** rubber-lined baskets.

4—Unused 4'x8' Kennedy-Van Saun **Coal Pulverizers** with motors, burners, piping, etc.

2—100 ton **York Refrigerating Units,** vertical type, each directly connected to 150 hp. synchronous motors, 3/60/440 volt.

2—135 hp. **Erie City Lentz Engines** 14x18, 200 r.p.m. connected with

2—**Connersville Blowers,** 15.8 cu. ft. per rev., at 6 to 10 lbs. air, 3000 c.f.m., 12 in. discharge. Can be sold separately from engines.

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2—**Devine Impregnating Units.**
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1—**Stokes** 2½'x8' **Rotary Vacuum Dryer.**
1—**Stokes** 3'x15' **Rotary Vacuum Dryer.**
4—**Shriver** 30"x30" **Iron Filter Presses.**
4—**Raymond Mills,** No. 0000, No. 00, and No. 1.
1—150 Gal. **Copper Jack. Agit. Kettle.**
1—Day, 150 Gal. **Jack. Tilt'g Mixer.**
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1—**Abbe Eng.** 2 **Jar Mill.**
1—**Abbe** No. 3, 54"x42" **Pebble Mill.**
1—**Abbe** No. 3C, 54"x60" **Pebble Mill.**
1—**Abbe** No. 6, 30"x33" **Pebble Mill.**
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2—**Devine Vac. Pumps,** 8"x8".
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Stainless Steel Jacketed Kettles 44"x11' (new).
500 gallon **duriron agitated kettle.**
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1—**Sweetland Filter,** 24-30" copper leaves
1—No. 5 **Sweetland Filter,** brewery type
1—**Kelly** type 150 **Filter**
1—50 gal. **W. & P. Jacketed Mixer**
4—**Pebble Mills**—30 to 200 gal.
4—**Williams, Gruendler, McCain Hammer Mills**
1—**Devine** 11 shelf vac. cham. **Dryer**
3—**Devine** 2-stage rotary valve 8x6" Vacuum Pumps
2—3x16' direct heat **Rotary Dryers**

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5—1600 gal. Nitrator Kettles
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"Chem. and Met." tenders its apologies to the Consolidated Products Company for inadvertently discounting the company's experience as distributors of used chemical and process equipment. The "10 years" featured in the November advertisement should have appeared as "20 Years of Experience."

See page 151 for the Consolidated Products Company's current advertisement

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LABORATORY VOCATIONAL AND LIBRARY FURNITURE

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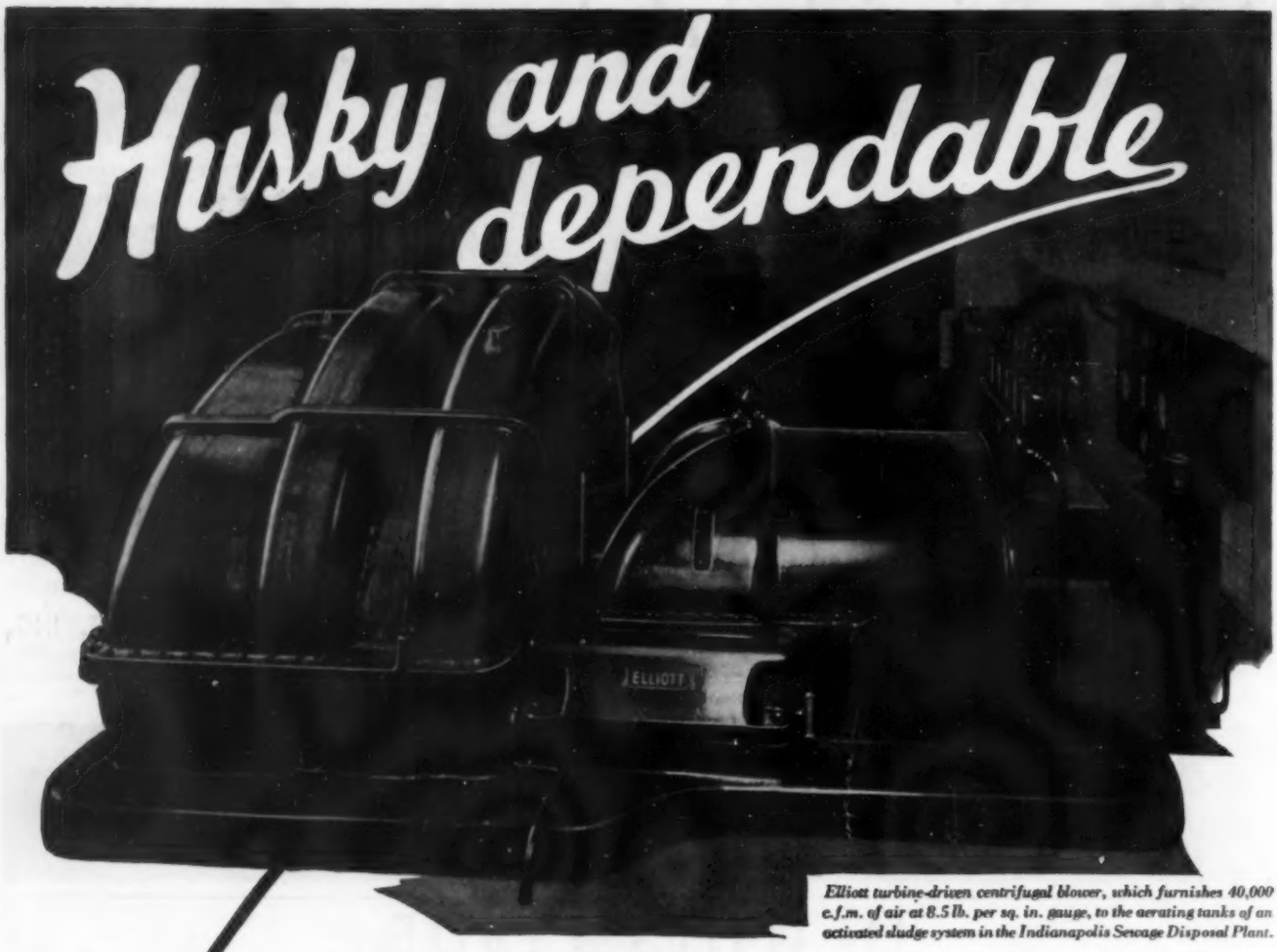

Elliott turbine-driven centrifugal blower, which furnishes 40,000 c.f.m. of air at 8.5 lb. per sq. in. gauge, to the aerating tanks of an activated sludge system in the Indianapolis Sewage Disposal Plant.

an ELLIOTT Centrifugal BLOWER

A typical Elliott blower installation is the one pictured here. It is rugged, simple, compact, smooth-running. Freedom from inherent vibration insures long life with maintenance at an absolute minimum.

The unit is Elliott throughout. The multi-stage blower is driven by an Elliott 1820-hp. turbine, which exhausts into an Elliott surface condenser.

Elliott blowers are designed by engineers with adequate application experience in widely diversified fields. Special materials are used when corrosive gases or other considerations require them.

Elliott Company builds centrifugal blowers for compressing air or gas to pressures of 1 lb. to 100 lb. gauge, volumes from 1000 cu. ft. per minute upward. Elliott Company builds the driving motor or turbine as well as the blower, with speed increasing gears when required, insuring unified design and responsibility.

Investigate Elliott blowers for your application.

ELLIOTT COMPANY... PITTSBURGH, PA.

Centrifugal Blower Dept., JEANNETTE, PA.

District Offices in Principal Cities

P-1037

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